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VOLUME 31 NUMBER 7

The Journal

OF THE

AMERICAN DENTAL ASSOCIATION

Use of Vinethene—*Chilton*

Acrylic Teeth—*Mann and Applegate*

Some Periodontal Problems—*Tishler*

Sterilization of Instruments—*Tainter et al.*

Surgical Treatment for Neuralgia—*Bourgoyne*

Dental Health for American People—*Robinson*

Protective Metamorphosis of Dentin—*Thomas*

Evaluating Acrylics for Restorations—*Saffir*

Roentgenographic Examination—*Swenson*

Development of Dental Corps—*Mills*

General Practitioner—*Blackwell*

APRIL 1, 1944

CONTENTS

Paul W. Zillmann, D.D.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

Protective Metamorphosis of the Dentin: Its Relationship to Pain.
B. O. A. Thomas, D.D.S., M.S. 459

The General Practitioner Must Be a Specialist in Prevention.
Robert E. Blackwell, D.D.S., M.S. 464

Roentgenographic Examination of the Edentulous Mouth.
Henry M. Swenson, B.S., D.D.S. 475

Chemical Sterilization of Instruments.
M. L. Tainter, M.D.; A. H. Throndson, D.D.S.; R. R. Beard, M.D., and R. J. Wheatlake, A.M. 479

Roentgenographic Study of the Teeth of a Group of Dentists.
George Ballard Diefenbach, B.S., D.D.S., and Harold Allen Eskew, A.B., D.M.D. 489

Surgical Treatment for Trifacial Neuralgia.
Julious R. Bourgoyne, B.S., D.D.S. 492

Some Periodontal Problems.
Benjamin Tishler, D.M.D. 496

Use of Vinethene as an Adjunct in Nitrous Oxide-Oxygen Anesthesia for Dental Surgery.
Neal W. Chilton, B.S., D.D.S. 502

Acrylic Teeth as a Means of Obtaining Balanced Functional Occlusion in Partial Denture Prosthesis.
W. R. Mann, D.D.S., M.S., and Oliver C. Applegate, D.D.S., D.D.Sc. 505

Actinomycosis: Report of Case.
Ralph Howard Brodsky, D.M.D., and Jack S. Klatell, B.S., D.D.S. 515

Further Studies in Evaluating Acrylics for Masticatory Surface Restorations.
Jacob A. Saffir, D.D.S. 518

The Problem of Dental Health Care for the American People.
J. Ben Robinson, D.D.S. 524

Factors in the Development and Progress of the Army Dental Corps.
Robert H. Mills, D.D.S. 531

EDITORIAL DEPARTMENT

Is the Dental Corps Meeting Its Obligations to the Armed Forces? 537

Correction 539

1944 Red Cross War Fund 541

ASSOCIATION ACTIVITIES

Bureau of Public Relations—Council on Dental Therapeutics—Committee on Legislation—Horace Wells Centenary—Committee on Economics—Council on Dental Health—Insurance Committee—Army Dental Corps— Procurement and Assignment Committee— ..... See Special Contents for Association Activities, page 543

OBITUARIES

George P. Evans (1892-1944) 565

Deaths 565

Current Literature 567

Announcements 575

ADVERTISEMENTS

Index to Advertisements A-65

Classified Section A-58

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PROTECTIVE METAMORPHOSIS OF THE DENTIN: ITS RELATIONSHIP TO PAIN

B. O. A. THOMAS, D.D.S., M.S., New York, N. Y.

OPERATORS who are interested in attaining the best results have long considered the application of a knowledge of the microscopic anatomy of the teeth to cavity preparation an important phase of their work. Great as has been the stress placed on the importance of preparing cavity walls in the direction of the enamel rods, the direction of the dentinal tubules has received scant consideration. Bodecker[1] has called attention to this fact.

The question of age changes in the dentin has been discussed in the literature by Beust,[2] Bodecker,[3] Lefkowitz,[4] Bodecker and Lefkowitz[5] and others. In young (recently formed) teeth, the dentinal tubuli are open channels, allowing the relatively free circulation of the dental lymph[5, 6, 7, 8] through the dentin and, to a lesser degree, through the enamel. As the age of the tooth increases, the dentin gradually undergoes changes which result in the occlusion of its tubules, a condition designated as protective metamorphosis by Bodecker.[1]

From the Divisions of Oral Histology and Operative Dentistry, Columbia University, School of Dentistry.

Lefkowitz[4] has correlated the protective metamorphosis of different regions of the individual teeth with their posteruptive ages. In addition to protective metamorphosis as a normal result of aging, the condition can be induced by abrasion, erosion or caries. It is a common clinical experience to find recently erupted teeth more sensitive during operative procedures than teeth that have undergone aging processes with resulting protective metamorphosis of the dentin and secondary dentin formation. If protective metamorphosis and secondary dentin formation are definitely related to a reduction of pain during operative procedures, it should be possible to demonstrate such a fact clinically, and to verify it with histologic preparations in the laboratory. In case such a relation is demonstrable, the knowledge might well be utilized to reduce pain in preparing cavities.

In order to test the foregoing hypothesis, the following procedures were carried out: Vital teeth (tested electrically) showing (1) slight gingival recession without cervical caries or abrasion (Figs. 1 and 2), (2) well-defined areas of

cervical caries or abrasion, or both (Figs. 3 and 4), or (3) marked gingival recession with or without cervical caries or abrasion (Fig. 5) were studied. With a small round or inverted cone bur making 1,200 revolutions per minute, a small cavity was cut into the dentin at the cervical area, paralleling as closely as possible the direction of the dentinal tubules. Drilling was stopped immediately if the patient felt pain. Figures 1 through 5 show the result in different cases.

The cases illustrated in this paper show clinically a definite inverse ratio between the degree of protective metamorphosis and secondary dentin formation, and the sensitivity of the dentin to the dental bur. In Figure 1, where the dentin in the operative area is still in the young stage, with the dentinal tubuli filled with dental lymph, it was impossible to cut into the dentin without causing definite pain. The tooth shown in Figure 2 had undergone slight protective metamorphosis in the cervical region, and it was possible to cut into the dentin a short distance before the patient's pain threshold was crossed.

It is a well-established fact that different teeth in the same mouth will vary considerably in their sensitivity to operative procedures. Figures 3 and 4 are especially interesting from this standpoint, since they were from the same patient and were operated upon and extracted the same day. These two figures illustrate very well the discrete tracts of protective metamorphosis that develop in the dentin under abrasion, erosion or caries. So long as the bur remains in the completely metamorphosed area of

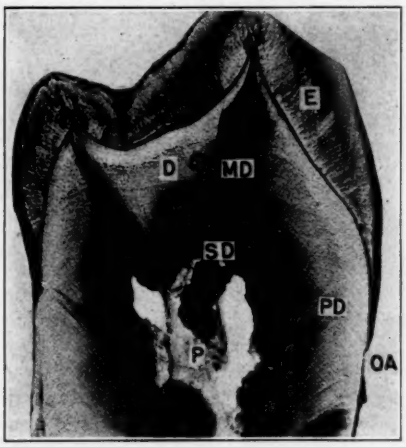

Fig. 1.—Vital lower first bicuspid in case of woman aged 54 years; showing slight gingival recession in buccal gingival area. A No. 1 round bur was used to cut the tooth. Pain was felt immediately upon entering the dentin. Figs. 1-7 are low-power photomicrographs of ground sections. OA, operative area. E, enamel. D, dentin. P, pulp. SD, secondary dentin. MD, metamorphosed dentin. PD, permeable dentin.

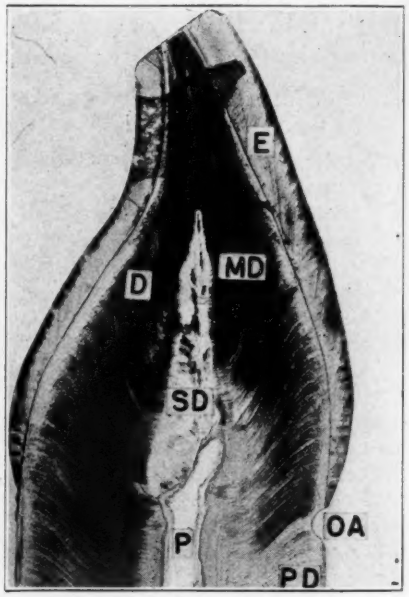

Fig. 2.—Vital upper central incisor in case of man aged 39 years; showing gingival recession similar to that in Figure 1. A No. 1 round bur was used to cut into the tooth and cutting continued until pain was felt. The dentin in the operative area is partially metamorphosed.

dentin, there is no pain to the patient. However, as these cases show, discomfort is experienced as soon as the bur passes into dentin where protective metamorphosis is incomplete or absent.

In older patients, where there has been recession of the gingivae for a period of years, and the dentin in the area of operation has become rather completely metamorphosed, it is possible to cut very deeply without causing any pain, as is shown in Figure 5.

Since the evidence presented tends to bear out the hypothesis that the greater the degree of protective metamorphosis, the less the pain resulting from operating in that area, we must see what clinical application can be made of such knowledge. A considerable number of data can be presented relative to the occurrence of protective metamorphosis under occlusal or incisal abrasion or attrition, as well as under carious cavities and various types of fillings. Bodecker[9] discusses this in his paper dealing with the benefits to be derived from the use of temporary fillings. In occlusal and proximal cavity preparations, several factors must be considered in order to have a satisfactory end-result. These factors include extension into self-cleansing areas, elimination of unsupported enamel, correct sloping of walls for resistance and retention, with sufficient depth for strength of filling material, and the elimination of deep pre-carious fissures and grooves. Any or several of these factors may involve cutting tooth structure well outside the boundaries of dentin that has undergone protective metamorphosis. Such cutting will be painful to the patient.

Those factors mentioned above that

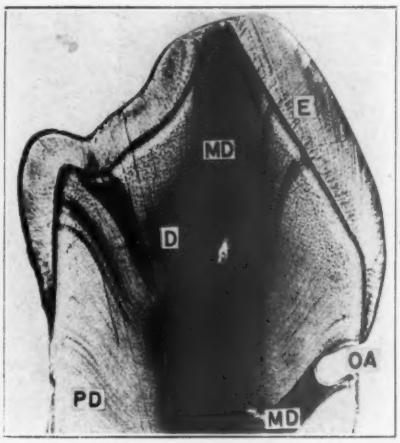

Fig. 3.—Vital lower right first bicuspid in case of woman aged 46 years. Recession of the gingiva was more marked than in Figures 1 and 2, and was accompanied by slight loss of tooth structure (erosion or abrasion) in the cervical area. A No. 1 round bur was used to cut the tooth (OA). When the bur had penetrated to the depth shown, a sudden sharp pain was felt. The edge of the bur is just passing out of area of protective metamorphosis.

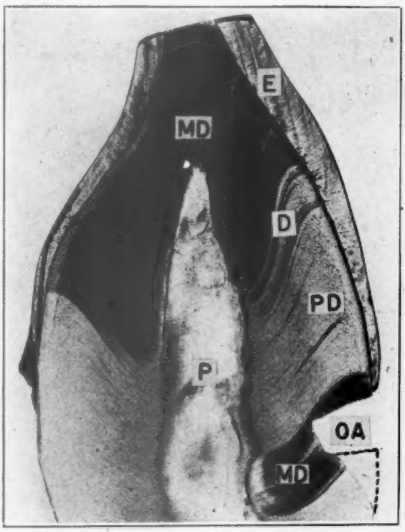

Fig. 4.—Case referred to in Figure 3; vital lower left cuspid. The procedure described in Figure 3 was employed, except that a No. 33½ inverted cone bur was used. Sudden sharp pain was experienced when the bur passed out of the tract of protective metamorphosis. The dotted line indicates the portion of the specimen lost in preparing the ground section.

are most important in cavity preparations in the cervical area are resistance and retention form. These can be obtained just as readily in the direction of the dentinal tubuli as at an angle to them. There is usually no stress on fillings in the cervical region, and resistance form is of importance chiefly during the filling operation. I believe that the type of cavity preparation shown in Figure 7 meets all the requirements of good operative procedure. It follows the direction of the dentinal tubules, thereby allowing the enamel to continue receiving its small, but important supply of dental lymph, without which the isolated enamel margins tend to become dried out and liable to fracture. The cavity preparation can be confined to the area involved by caries or abrasion; and, by staying in the tract of protective metamorphosis, it can be prepared with little or no discomfort to the patient.

Naturally, it is not possible to prepare every cervical cavity painlessly by merely cutting in the direction of the dentinal tubuli. If there is gingival recession of long standing, or definite caries or abrasion, in a middle-aged patient, we should expect to operate in the cervical area with less discomfort to the patient if we follow the direction of the tubules rather than cut the conventional type of Class V cavity. In young patients, with recently erupted permanent teeth that are suffering from rapid carious destruction in the cervical region, protective metamorphosis and secondary dentin will not be present. In these cases, as in cases of "sensitive necks," the most effec-

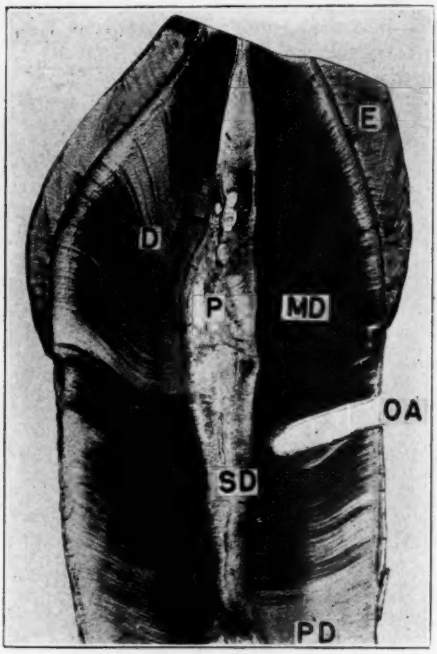

Fig. 5.—Vital lower right central incisor in case of woman aged 54 years; showing gingival recession more marked than in previous cases. No pain was experienced in cutting into the tooth with a No. ½ round bur to the depth shown. There was very marked metamorphosis of the dentin.

tive means of operating painlessly is the use of obtundents or local anesthesia.

The progressive, alert dentist will use every means at his command to operate with the least discomfort to his patients. A knowledge of the histology of the dentin and of the changes that occur in this tissue is merely another tool in his armamentarium. Protective metamorphosis and secondary dentin formation will help him if he will only accept their aid.

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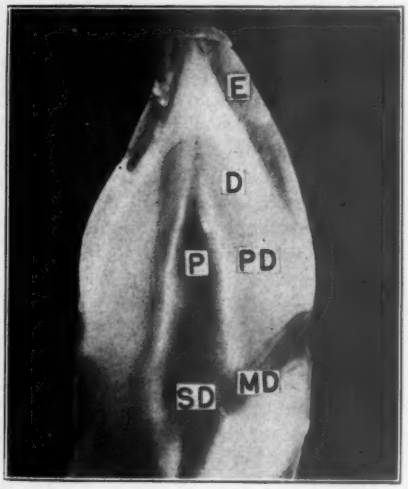

Fig. 6.—Lower cuspid tooth (photomicrograph taken by reflected light). Sectioning showed early cervical caries and tract of protective metamorphosis confined to those dentinal tubules having origin in the involved cervical area. Cervical abrasion also initiates protective metamorphosis of the dentin. Secondary dentin has formed on the pulpal end of the tract of metamorphosed dentin.

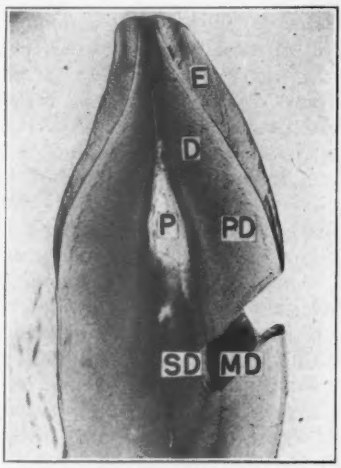

Fig. 7.—Tooth shown in Figure 6. A cavity was prepared in the sectioned specimen to illustrate the type of cervical preparation that can be made parallel with the direction of the dentinal tubules to take advantage of the decreased sensitivity caused by protective metamorphosis and secondary dentin formation.

THE GENERAL PRACTITIONER MUST BE A SPECIALIST IN PREVENTION

ROBERT E. BLACKWELL, D.D.S., M.S., Chicago, Ill.

BEFORE entering into a discussion of the rôle of the general practitioner in prevention, it would seem advisable to come to an understanding as to what we mean by prevention. Prevention, of course, means to preclude the onset of disease—to employ prophylactic measures to thwart the beginning of morbid processes. In this paper, I shall use the term "prevention" as including not only efforts to forestall incipient disease, but also measures taken by the operative dentist to correct minor difficulties in order to prevent pathologic conditions of a serious nature. Arthur D. Black,[1] in rewriting his father's texts, defined operative dentistry as "[consisting] of all procedures, including preventive measures, by which the teeth may be conserved and thus maintain the masticating mechanism in such a state that the general health will not be endangered." Preventive dentistry, then, is conservative dentistry and, to be effective, should include diet and nutrition, mouth hygiene, so-called prophylaxis, operative dentistry and the education of the patient, all coordinated in a well-planned program based on a periodic recall system.

More than fifty years ago, W. D. Miller[2] promulgated his chemicoparasitic theory of dental decay. G. V. Black and J. Leon Williams[3] furthered the knowledge of the pathology of caries, Black[4] developing a system of cavity preparation designed not only to arrest caries, but also to prevent recurrence on the same surfaces and to facilitate restorations protecting the gingivae from subsequent injury. The principles which Black emphasized and organized into a system of operative procedures are sound. In my opinion, the Black system of operative dentistry still stands as the greatest forward step in prevention. While formerly recurrence of caries around restorations was usual, not to say expected, today it is comparatively rare when the operations are well-planned and executed.

Recent studies by research groups have finally begun to yield results with respect to the etiology of caries. When such information as is now available becomes general and is applied, the incidence of dental caries may be considerably reduced. The great difficulty here is to get the public to apply the necessary measures after being made aware of them.

In a recent issue of the *Northwestern University Dental School Bulletin,* Leonard S. Fosdick[5] analyzed the caries problem from the point of view of the chemist. The report of his studies throws much needed light on the caries problem and helps to explain some phenomena which have baffled the clinician. I shall refer to some of his results here.

Recognizing that the chemicoparasitic theory of Miller and Black still holds good and that caries is an acid decalcification, Dr. Fosdick explains that the mechanism of acid formation as now understood consists of a series of rather complex reactions, each of which is

Read at the Seventy-Eighth Annual Postgraduate Meeting, Ohio State Dental Society, Cleveland, November 9, 1943.

governed by a complex system of enzymes. The acids that are formed can come only from carbohydrate material. Probably most of this acid is derived from fermentable sugars.

As the mouth of every person has an enzyme system capable of converting sugars to acids—a significant fact—anybody may develop caries provided there is sufficient substrate—that is, carbohydrate material—in the mouth and provided the buffering power of the saliva is not sufficient to neutralize the acid formed. Although acids can be formed in all mouths, they are formed much faster in caries-active mouths than in caries-immune mouths. Furthermore, in case there is an optimum enzyme system in the mouth, acids are formed in a few seconds. As most persons do not have an optimal enzyme system, it usually requires a few minutes rather than a few seconds for the formation of acids of sufficient concentration to do much harm. Nevertheless, these acids are formed rapidly and, in many caries-active mouths, the maximum concentration is found from fifteen to twenty minutes after the ingestion of sugar.

In general, the saliva is highly buffered and can neutralize large quantities of acids. This buffering power of the saliva, according to Dr. Fosdick, is about 40 per cent higher in the mouths of caries-immune persons than in the mouths of the caries-susceptible. It appears to be entirely probable that even in the cases of the highly susceptible, there is sufficient neutralizing power in the saliva to prevent caries if active or flowing saliva bathes all tooth surfaces continuously. But this condition does not usually exist.

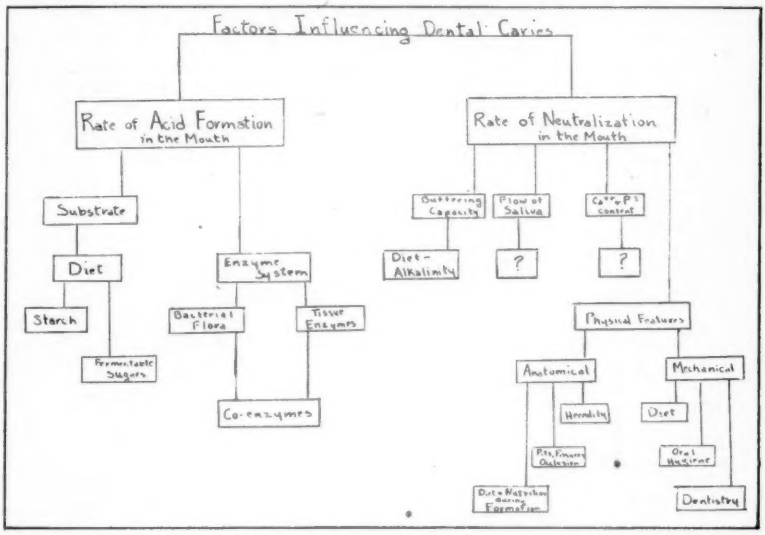

Figure 1. Courtesy L. S. Fosdick.

From the foregoing, it may be seen that the principal factors in susceptibility to dental caries are the rate of acid formation and the rate of acid neutralization. At least, this could be true if anatomic conditions and the occlusion were identical in all cases.

The rate of acid formation depends almost entirely on the enzyme system and the substrate. Without the substrate, it is impossible for acids to form. The

substrate is fermentable sugar and starch, sugar being the offender in about 90 per cent of the cases examined in clinical studies and starch in about 10 per cent.

The enzyme system is probably regulated by the flora of the mouth. No doubt *Lactobacillus acidophilus* plays an important part here, but it appears to be true that no single organism can develop an optimal enzyme system.

The rate of acid neutralization is largely governed by the buffering capacity of the saliva, the flow of saliva, the mouth or an increase in the rate of neutralization, or both, being necessary. But it is not so simple as that. Fosdick states that experiments designed to increase the rate of neutralization in the mouth have not been generally successful, although fairly satisfactory in some cases. Also, and this is important, the modern diet is so high in carbohydrate that it is impossible to increase the neutralizing power of the saliva sufficiently to cope with the situation. Furthermore, we all know that malocclusion and anatomic malformations are, perhaps in most mouths, conducive to stagnation of the saliva and to food retention.

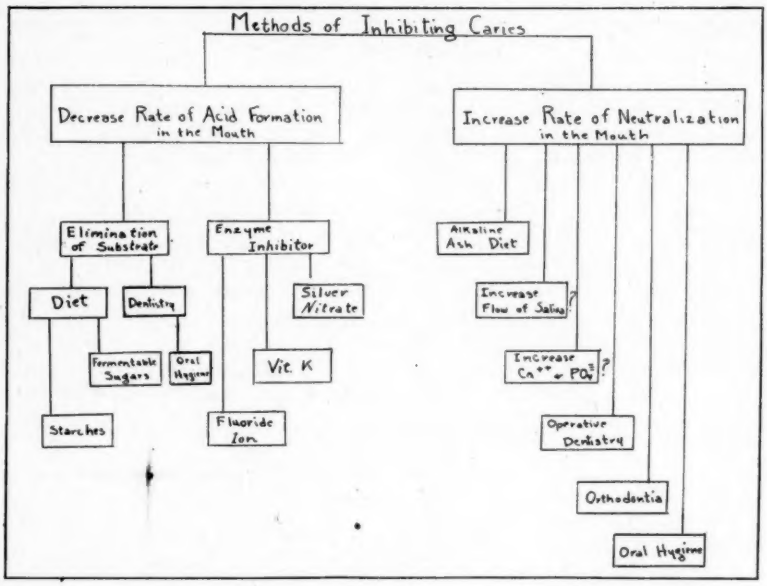

Figure 2. Courtesy L. S. Fosdick.

form and arrangement of the teeth and the mechanics of mastication. An alkaline ash diet is strongly advised because it is known to increase the buffering power of the saliva. At the same time, warning is given that a large amount of free sugar is not conducive to an alkaline ash.

From what has just been stated, the control of caries might appear to be a rather simple matter, merely a decrease in the rate of acid formation in the

From the chemical aspect of the problem, caries control can, in some instances, be effected by means of enzyme inhibitors. For many years, silver nitrate has been used more or less empirically to prevent or arrest incipient caries. It is now known that it functions thus because of its potency as an enzyme poison.

The fluoride ion has also been shown

to be an enzyme poison and, for that reason, some individuals and certain groups are strongly advocating the addition of fluorides to the communal water supply in order to reduce the incidence of dental decay. In this connection, it is interesting to note that while some towns have already changed their water supply to a source free from fluorine in order to prevent enamel fluorosis, and no doubt other communities will do the same, it is being urged that fluoride be added to fluorine-free waters as a public health measure. The question of the intentional use of fluorides in drinking water, for the purpose of lowering the incidence of caries, is a subject for debate and further experimentation.

An examination of Figure 1, showing the factors in dental caries, and of Figure 2, showing the methods of inhibiting caries, should help to clarify the problems of caries control.

We are all aware of the difference of opinion among various investigators in regard to diet and dental caries, especially with respect to sugar and some of the vitamins, principally A, C and D. The book "Dental Caries,"[6] published by the American Dental Association, contains 237 reports of studies. In it may be found many theories as to caries etiology, some of them astounding. In an analysis of these reports, it is stated:

> Opinions are divided as to whether caries is due to dietary deficiency of any nutritional essential. There is little dissent from the prevailing judgment that a balanced diet, containing optimal amounts of all essentials for the production of perfect teeth, does not assure immunity from dental caries, if local (oral) conditions are favorable for the multiplication and destructive action, on dental areas, of acidogenic oral bacteria.

During recent years, the public has been bombarded by radio and press with propaganda for the use of vitamin concentrates, with the result that great quantities of these food accessories are being consumed. Milk has supplanted coffee or has been added to the diet in many homes and on many tables. Green vegetables are considered essential for a balanced diet by most housewives in planning their daily menus. These improvements in the daily dietary régimes of millions of people, in the middle and upper income brackets at least, have not resulted in a reduced incidence of dental caries. In fact, while the general health has been improved, the incidence of caries has increased. The per capita consumption of sugar is about 115 pounds annually, or was that until recently. There is no doubt in the minds of many of us that, without severe restriction of sugar in the daily diet, little headway can be gained in caries control. It becomes a matter of the cooperation of the patient; and it is difficult, if not impossible, to obtain full cooperation.

Recently, at a dinner in Chicago, I sat at the table with one of our able and well-known investigators in this field. Thinking that I would have a little fun with him, I said, "You know, it seems strange that, after all the fine work you and your group have done in caries control, we operative dentists still have the problem of control in our hands." I thought that he might be ruffled a bit, but he was not. He grinned and replied, "Yes, that's right. You have. But if I can put the patient in a hospital, I can control it!" Perhaps we should say to our uncooperative patients, "It's either the hospital for you or residence in Deaf Smith County, Texas."[7]

Now, I do not think that my distinguished dinner companion would have you and me believe that we cannot accomplish any good among patients who have a geat deal of caries activity by prescribing a diet calculated to lower the incidence of caries. He was talking about absolute control when he mentioned hospitalization. We can do something, at any rate, for we occasionally get a cooperative patient. There, ap-

parently, the result is a lowered incidence of caries. In my experience, it is usually extremely difficult to obtain cooperation even after elaborate explanations and the exaction of many promises. And so I suggest that we sharpen our chisels and go to work.

No plan of caries control from the operative side is adequate unless it begins with the small child, 3 years of age at the latest. Generally, something can be done after gaining the child's confidence. Usually, adequate service can be rendered. We have a rather large number of filling materials to choose from—copper cement, zinc cement, modified zinc cement, copper amalgam and silver-tin amalgam. Any one of these materials will give good service. Of course, the zinc and copper cements will wash out rather quickly and should not be employed except in cases extremely difficult to manage. But every month, every year added to the age of the child may make the next operation easier of accomplishment. I should say that if, in an extreme case, a cement filling lasted but a few weeks, the operation should be considered a success, since caries has been arrested and control is under way. Probably, the next time, a better restoration of amalgam can be made, a filling that will protect the surfaces involved during the full term of the deciduous tooth. Silver-tin amalgam is by all means the restoration medium of choice for occlusal and proximal surfaces in the deciduous molars.

Ammoniacal silver nitrate is a substantial aid in arresting incipient caries, particularly in cervical areas, but it cannot be depended on to protect the surfaces indefinitely. Applications should be repeated at least every three months. During each visit, the areas where it has been applied should be examined with a sharp instrument to determine whether decalcification is taking place under or around the blackened surface. The results are sometimes disappointing, although generally they are good. The duration of silver nitrate as an enzyme poison is not without limitations.

Some dentists advise the use of silver nitrate in occlusal pits of deciduous and permanent molars. When these pits or fissures are definitely carious or are suspected of being so, it is better to prepare cavities and make restorations. In no other way can we be sure about the condition; and, in private practice at least, it is our business to be sure.

The proximal surfaces of the anterior deciduous teeth are amenable to treatment either by filling or by permanent separation. As you know, it is not necessary to restore proximal contact because, as the jaws develop, the teeth move apart through the widening of the arch. Shallow proximal decay can be disked off, and the surface polished. Otherwise, it is left alone. Deeper decay areas will, of course, require filling. The modified zinc cements give excellent service here.

In dealing with the deciduous teeth, there are several important facts to be kept in mind. In our haste to relieve the little patient from nervous strain, we should never lose sight of these facts:

1. The onset of caries is sudden and its progress rapid.

2. The pulp chambers are very large in proportion to the teeth, and the pulps may be exposed very quickly by caries or they may be exposed by accident.

3. In the deciduous molars, it is important to maintain or to restore the full mesiodistal width of the teeth.

On the consideration of the first, we should bear in mind that frequent examinations are necessary if caries is to be discovered in its incipiency. In many cases, not more than three months should elapse between examinations. Bitewing roentgenograms should be made and be studied carefully for proximal decay. It is usually impossible to keep the child from consuming a considerable amount of candy, other sweets and highly sweetened drinks. The par-

ents may understand the desirability of reducing the consumption of sugar and take measures to that end, but there is no way of keeping relatives, friends and even strangers from offering tempting tidbits to children. If the continual ingestion of sugar in the form of candy, etc., cannot be stopped, the next best thing is to encourage rinsing the mouth immediately after eating in order to remove as much of the substrate as possible. As previously mentioned, Dr. Fosdick has shown that acids are formed quickly, so that rinsing a half hour after eating may be too late. Obviously, this measure is hardly practicable outside the home.

In the consideration of the second statement, we must bear in mind that exposure of a pulp may cause the loss of a tooth. Pulps of deciduous teeth can sometimes be capped successfully, but pulp capping is always a hazardous undertaking. Early discovery of caries and careful operating are essential to the conservation of these teeth.

As for the third fact, we should restore the full mesiodistal breadth of the teeth, not only to leave ample room for the succedaneous teeth, but also to maintain proximal contacts in order to prevent food impaction. Children as well as adults suffer injuries to the gingivae from food impaction. Because of these injuries, they may discontinue vigorous use of their teeth and habitually bolt their food. This results in uncleanliness of the mouth, less natural cleaning by the friction of food in mastication, probably a higher incidence of caries and improper preparation of food for digestion.

Dr. Prime[8] has emphasized the importance of immunizing the proximal surfaces of the upper permanent incisors with silver nitrate as soon as they have come into contact. Certainly this should be done repeatedly until the child has reached a state of at least partial immunity. Proximal cavities in the incisors offer such technical and esthetic difficulties that there really is no satisfactory restoration for them. In immunizing with silver nitrate, the rubber dam should be applied if it is at all practicable. It is difficult to maintain essential dryness without it. The dam affords protection from a possible misapplication and, at the same time, so improves the visibility that a thorough examination can be made. The treatment of proximal surfaces should be applied also to the bicuspids and molars as soon as they too are in contact, although, in my experience, it is not so successful with these teeth as with the incisors. But it at least postpones the time when restorations will be required, and that too is important. I do not believe that silver nitrate is a panacea in caries, but it is without a doubt preventive.

When this and other measures fail, we have no alternative but to make restorations. What kind of restorations are we going to make? The answer is "Good ones." But what materials are we to use, some one asks? "The ones that we can use best in a given case" should be the answer. One of my former teachers used to say that there is no best filling material. Certainly there is no single material that meets the requirements of all cases. The condition of the tooth, the condition of the supporting structures, the condition of the patient, the ability of the operator and perhaps the patient's ability to pay—all must be considered. Under favorable conditions, there is nothing better than gold foil. That can be said without fear of contradiction. Then should we place gold foil everywhere? My answer is "No." But there are many instances in which nothing else will be so satisfactory. In fact, conditions not only warrant its use, but demand it. Gingival third cavities in nearly all of the lower permanent teeth should be considered as favorable for the use of foil. Occlusal cavities in the bicuspids and molars, in mouths where

proximal decay is not expected, call for it. Proximal cavities in the incisors where appearance is not important demand it. There are other places where it may be used to great advantage, but those that I have indicated appear to be the most important.

The majority of dentists are using the silicate cements almost exclusively for proximal cavities in the incisors. These materials have been improved in recent years, and we know how to handle them better now than we did formerly. We know that to get a good result, we must use the rubber dam, take sufficient time and exercise as much care as we would in placing a gold foil filling or a gold inlay. But even when this is done, the incisal angles of the teeth are likely to be lost within a few years. The silicate cement filling gives no support to the incisal angle, which consequently breaks down. Until this fault is remedied, and I see no remedy for it, these cements must be considered unsatisfactory.

All of us have seen silicate cement fillings that have served satisfactorily for many years, but, in my observation and experience, these cases are exceptional. Early loss of contour and contact, shrinkage, bad margins—all contribute to the failure of silicate fillings. Closer attention to preventive measures, particularly with ammoniacal silver nitrate, and the judicious use of gold foil and an occasional gold inlay should serve to postpone indefinitely the use of the jacket crown or, perhaps, intricate bridgework.

One of our most serious problems lies with adolescents. I have carried a good many of them into adulthood with various degrees of success or perhaps failure. I have learned that it is entirely possible and practicable to bring them through this period without the loss of any pulps and with normally functioning teeth if I can have a fair degree of cooperation from the patient. When susceptibility to caries is high, caries will occur in spite of us. If the bitewing roentgenogram shows a "nick" in the enamel, or if the sharp, exploring tine discloses a loss of normal contour of the proximal surface (no examination is complete without the use of both), operative treatment is indicated. One cannot place too much emphasis on the early treatment of caries. When cavities have been prepared before there was any appreciable caries of dentin, the results have been excellent. The degenerating pulp usually is the aftermath of deep caries in the dentin. The ideal cavity is one that does not require the removal of carious dentin after the outline, resistance and retention forms have been obtained.

Restorations intended to be permanent should be made for the young patient as soon as is practicable. Temporizing with cements may be necessary at times, but often leads to loss of contact, injury to the gingivae, drifting of teeth and general derangement of the natural dentures.

Cavities for permanent restorations should be prepared with full regard to the rules of extension for prevention, including the gingival extension under the free margin of the gum. In elaborating on this statement, I shall quote at some length from a previous paper.[9]

In his close study of beginning caries of enamel, Black concluded that caries never occurred under the free margin of healthy gum tissue. This was purely a clinical observation. He considered the enamel to be immune from beginning caries as long as it was covered by healthy gingivae. This observation led to the recommendation that the gingival margins of cavities be placed under the gingivae and that contours and contacts be so restored as to assure the future health of the gingivae.

The more recent work of Gottlieb[10] on the epithelial attachment of the gingivae to the enamel, confirmed by such histologists as Noyes,[11] Orban,[12] Kronfeld[13] and Bodecker,[14] has caused some men to

question the practice of gingival extension for the prevention of future decay.

In writing of the epithelial attachment, Orban states:

Formerly, it was supposed that after the tip of the crown had broken through the mouth epithelium, a space existed between the enamel epithelium and the enamel, which space extended to the cemento-enamel junction (called "sub-gingival space"). Since 1921 we know from the work of Gottlieb that this conception is false and that no space exists between the enamel and the enamel epithelium. There is an organic connection between the enamel epithelium and the enamel, not only before, but during tooth eruption. Previous to tooth eruption the epithelium connected with the enamel is known as the reduced enamel epithelium. Immediately after eruption, as the free margin of the gum and the crevice is formed, the same epithelium is called the epithelial attachment. The epithelial attachment is that portion of the epithelium surrounding the tooth which is in organic connection with the surface of the tooth. . . . During the eruption the epithelium physiologically separates from the enamel and forms the gingival crevice. A probe placed in the space between the epithelium and the enamel will not reach the cemento-enamel junction, but stops at the point where the enamel epithelium is attached to the enamel or enamel cuticle.

Kronfeld states:

The former concept of the relationship between tooth and gingivae was that the gingivae are attached to the tooth at the cemento-enamel junction. The soft tissues crownward from the cemento-enamel junction were called the free gingivae. Investigations have shown that the condition just described does not exist and, consequently, all theoretical and practical considerations based on this concept had to be changed.

Orban and Mueller[15] have been severely critical of Black's teaching, although they acknowledge that his clinical observations with respect to beginning decay were correct. They quote Black thus:

Therefore, if decays in this position (gum margin, ref.) have begun in the child, they may be mid-length the crown when the child has arrived at adult age. Therefore the particular position of the beginning of these decays on the buccal surfaces will depend much on the age of the patient at the time of their beginning. They are, however, always near the free border of the gingivae at the time of their beginning. If such cavities are filled for young persons without pushing the gingivae well back in each case so that the border of the cavity can extend well under it, the natural shrinkage of the gingivae will soon expose the enamel between the gingivae and the filling. This will then be liable to decay again.

In commenting on this quotation, Orban and Mueller say:

Here is the practical conclusion and we see clearly where the mistake was made. We cannot push the gum back far enough to keep the fillings permanently under the gum. If the gum is healthy, as Black requires it to be for protection, the free gingivae are very short and there is practically no crevice. If we force the gum away, we separate the epithelial attachment from the tooth, and by so doing, we injure and damage the supporting structures.

Such statements as those quoted above have cast a heavy shadow of doubt on the practice of gingival extension for prevention of future decay and no doubt have served to confuse some young dentists who desire to render the best possible service to their patients. The criticisms by Orban and Mueller, then, are that extension gingivally under the gum does not protect the gingival margins of restorations permanently and that the supporting structures are damaged by such extension. These criticisms warrant closer examination.

Until the time that Black crystallized the best thought and practice of the dental profession and gave it the name "extension for prevention," dentists the world over were meeting with failure after failure in their attempts to restore carious teeth by means of fillings with some degree of permanence. Caries susceptibility was high then, as it is now.

The best contour restorations of gold foil would fail from time to time because of recurrence of decay around the margins. This, of course, was discouraging to both the dentist and his patient. As the knowledge of the pathology of dental caries became more general and the principle of cavity outline was better understood, these failures decreased in number, and dentists could be confident that their restorations would give years of service. Much of this success was the result of gingival extension under the gum. It has been my privilege to see many restorations, particularly proximal restorations, that were made by G. V. Black, Thomas L. Gilmer, Arthur D. Black and others of less prominence but no less skill, which have endured from thirty to forty years. In these cases, the gingival margins of the restorations had been placed under the gingivae. Thousands upon thousands of dentists have observed this in connection with their own operations. Have these gingival margins of restorations always remained under the gingivae as the years went on? Not by any means. The important point in this connection is that the gingival margin of the restoration remains covered by the healthy gum during the years of greatest susceptibility to caries. The shortening of the gingivae goes on naturally as age advances. Also relative, if not complete, immunity is commonly attained in adult life. When the gingivae have shortened in later years to the point of exposing the gingival margin of the restoration, natural immunity has served to lend permanence to the restoration.

Do such extensions "injure and damage" the supporting structures? This question should be answered by the dentist who observes the results of his efforts year after year rather than by the histologist who reports the existence of the epithelial attachment to the enamel. Of course, injury can be done, and often is done, by careless operators or by accident. But if reasonable precautions are observed in operating, the good that can be accomplished in preventing the recurrence of caries far outweighs the harm, if any, that might result to the gingivae. In this connection, it should be emphasized that G. V. Black continually cautioned his students that the gingivae should not be injured during operation and that the contours and contacts of restorations should be so formed that the gingivae would be permanently protected against injury. Moreover, Dr. Black did not advise radical retraction of the gum. It was certainly never his intention that the gingival margins of cavities should be extended to the cemental line. A close study of any of his textbooks will fail to disclose one illustration of a prepared cavity that shows the gingival margins thus extended.

Apparently the discovery of the epithelial attachment and the warnings as to its injury have caused many dentists to abandon the demonstrably sound practice of placing the gingival margins of cavities under the gum. In a discussion of this subject, F. B. Noyes[16] said:

> In my judgment the question of the attachment of the epithelium to the enamel is still a controversial one, and while I believe that Dr. Gottlieb presented some very important and very significant facts, I also believe that some of his conclusions from those facts are not correct, and that the facts themselves have not been fully uncovered. For instance, we still know very little about the nature of this attachment, and some very important investigations should be made to determine this. I am going to carry this statement one step further: I believe that this very theory, this very statement of observed facts, true as they are, have injured the quality of dental restorations in the last fifteen years. In radiograms, time after time, proximal restorations will be seen with the gingival margin of the restoration exactly at the point of contact. The argument that the attachment of the epithelium to the enamel should not be disturbed and that consequently proximal cavities should not be extended to the gingival, has definitely reduced

the therapeutic value of dental filling procedure in the prevention of dental caries.

This statement is timely and straight to the point. In the majority of instances, failure to extend smooth surface cavities under the gingivae will result in the early failure of the restoration. G. V. Black gave us a system of cavity preparation which has proved to be sound in every respect. When dentists today, in their routine procedures, violate the principles which he laid down, they are guilty of retrogression and their patients do not receive the best service that modern dentistry has to offer.

It was recognized by Black that there was no fixed formula which would govern every case. There was always an exception to the rule. This was true with respect to the principle of extension for prevention. Dr. Black emphasized the principles upon which sound operative procedures were based without ever stating in exact terms just how each case should be treated. His rules governing cavity outline are stated in terms which leave the details to the operator. There are some dentists, however, who believe that Black's directions for gingival extension of cavities were not given in sufficient detail. For this reason, I shall attempt to give a more specific interpretation of Black's ideas, although it may appear presumptuous to do so:

1. All carious enamel and enamel undermined by carious dentin should be removed. In many instances, this alone will carry the gingival margin under the gum.

2. In young persons, that is adolescents and young adults, the cavities should almost invariably be extended under the gum. The gingival margin should not be too near the proximal tooth. Where the teeth are thick necked and the proximal surfaces lie close together for a considerable distance occlusogingivally, cavities should be extended farther gingivally than would otherwise be necessary.

3. In adult and middle-aged patients, where the gingivae have not been shortened appreciably, the cavities should extend under the gum unless there are definite signs of immunity to caries. If immunity has been established, extension under the gum should not be necessary.

4. In elderly or younger patients, if the gum has receded considerably, it is usually unnecessary to make gingival extensions.

These recommendations are made after giving full consideration to the comparatively recent knowledge pertaining to the epithelial attachment. Clinically, demonstration of this attachment is difficult. Apparently, it is a frail structure. Perhaps the epithelium is detached and reattached from time to time. If the maintenance of this attachment were as important as some men seem to think it is, then all clinical practice would need to be radically revised. Clinical experience, however, does not justify a change in operative procedure.

This problem of tooth conservation, then, is indeed a difficult one. Yet by the application of our present knowledge of prevention through control of the diet, immunization, mouth hygiene and treatment by means of restorations, it should be, and usually is, possible to bring a patient from preschool age to adult life without the loss of a pulp and with healthy supporting structures.

The adult period is usually marked by lessened susceptibility to caries and by an increased tendency to inflammation of the gingivae and resorption of the alveolar process. It is much easier to control caries during this period, but it does not follow that we can permit any laxity on the part of our patients in presenting themselves for periodic examination or on our own part in making thorough examinations. As the gingivae gradually shorten and the alveolar process gradually resorbs—a natural phenomenon—proximal contacts may weaken, food leaking in between the teeth, with

resultant caries near the cemental line; or pus pockets may be established. It is imperative that these conditions be watched for and corrected whenever or wherever discovered. It will be necessary to again make restorations from time to time because of recurrent caries or to correct contours and rebuild contacts. Only if these conditions are studied carefully and corrected can the integrity of the dental arch be maintained for years. It is not my intention here to imply that this plan of treatment will prevent all periodontal disease. It is expected, however, that, in a high percentage of patients, a healthy condition of the natural dentures can be maintained well into advanced years or even throughout life.

The program that I have outlined is not original. I have drawn heavily upon the experience and writings of Arthur D. Black and others. It represents merely the ideal toward which many of us strive. Besides a great deal of hard work on your part and mine, it calls for patience and perseverance; and, by all means, it calls for a secretary who will tactfully and persistently see to it that the patients come in at the proper time for examination.

Probably the majority of dentists in general practice, particularly in urban communities, maintain some sort of system of periodic recall of patients. In some offices, this is done principally for the purpose of maintaining an even schedule of appointments. In unusually busy times, the notices may not be sent out until a slack period occurs, or there may be a breakdown of the entire system through carelessness. This should be considered a calamity. If young patients, particularly, are allowed to go beyond the time limit for their recall, the chain of preventive measures may well be broken, in which case failures are inevitable.

I am convinced that there is no phase of dentistry that offers greater opportunity for service than prevention. The dentist who recognizes this fact and cares for his patients in such a way as to conserve their teeth in function and health during the childhood period, the period of greatest susceptibility to dental caries, and through the adult period of greatest damage to the investing tissues, renders invaluable health service. The problem of focal infection as it concerns dentistry will be well on the way to solution when the dental profession as a whole has learned to apply the knowledge and employ the technics that are now available. Any dentist in general practice who conscientiously carries out such a program becomes a specialist in prevention.

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ROENTGENOGRAPHIC EXAMINATION OF THE EDENTULOUS MOUTH

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BEFORE the discovery of the x-rays, it was obviously necessary for the prosthodontist to depend entirely on the patient's history and digital and visual examination in determining whether the ridges would be suitable for dentures. However, when this type of incomplete examination has been supplemented by the use of x-rays, all too frequently many pathologic conditions have been revealed in ridges that otherwise would have passed unnoticed. Therefore, complete x-ray pictures of the maxillae and mandible are indicated for the full denture candidate, provided one wishes to establish sound and healthy bases for appliances. In spite of the generally recognized importance of the x-rays in the examination and preparation of ridges for dentures, clinical experience continues to reveal evidence of failure to use this valuable roentgenologic method. Eusterman surveyed 230 partially edentulous or edentulous mouths at the Mayo Clinic. The majority of dentures in this series of cases had been in place on an average of more than eight years. Eighty-nine cases showed retained roots, and nine of these showed residual areas of infection.

In another survey from the Mayo Clinic, published by Gardner and Stafne, 2,112 patients were examined to obtain data on 20,000 edentulous areas from which teeth had been extracted previously, outside of the Mayo Clinic. Of this number, 469, or 22.2 per cent, of the patients had one or more retained root tips. The total number of retained roots was 903.

Molt examined a series of 900 areas and found that 48 per cent showed remaining roots or presented evidence of residual or retained infection. Cook reported on 500 cases examined roentgenographically. Of the total number of patients examined, 120 were edentulous and 29 per cent of these showed retained roots.

The purpose of this survey is to point out and to emphasize again the need for complete x-ray examination of all edentulous patients who are to have artificial dentures constructed. Without a complete perception of existing conditions, any treatment that may be undertaken becomes empiric and unreliable.

The material used for this report was obtained from the Department of Oral Diagnosis at Indiana University. The patients whose records were examined for this study presented apparently edentulous mouths. The oral condition of all was determined by clinical examination and a complete set of intraoral roentgenograms. The general physi-

From the Department of Oral Diagnosis, Indiana University, School of Dentistry.

cal well-being of the patient was determined by interrogation and history taking. A surprising number of retained roots, unerupted teeth and other abnormalities were discovered in the x-ray examination of these patients.

During the period covered by this report, a total of 381 patients came to this clinic with apparently edentulous mouths and were examined roentgenographically. Many of these had been wearing dentures for years over retained roots without any noticeable discomfort. There was only an occasional case in which failure of the denture was attributed to the presence of retained roots. One patient who was a dissatisfied denture wearer had six root tips remaining and a history of a chronic discharge from the alveolar process.

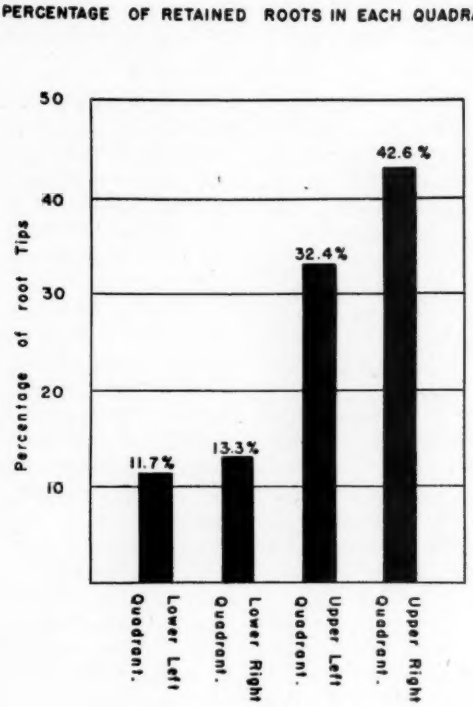

Figure 1.

From this group of 381 patients, 122, or 31.23 per cent, had retained root tips. In round numbers, one of every three patients had retained and unsuspected root remnants. Altogether, 188 root fragments were found in the 381 patients examined. One-half, or 190, of the total number of these patients had worn dentures before admission to this clinic.

Of the total number of root ends found, 9.6 per cent had areas of radiolucency around them. There is some disagreement among pathologists as to the seriousness of this local reaction. Some believe it is a favorable response, with the formation of granulation tissue which either destroys or retains any harmful agent within itself. Others are

of the opinion that it is an infectious lesion or focus from which toxic substances may be disseminated and that it should be eradicated.

Irrespective of the possibilities of these areas as foci of infection, they may become active as granulomas or cysts. In this manner, local bone destruction may become so extensive that a new appliance may be necessary. To reduce this possibility, all retained roots showing radiolucent areas should be removed.

The statement has been made that the mandibular teeth are more difficult to extract because the alveolar bone is denser than it is in the maxillae. The results of this study do not agree with this concept since 75 per cent of all the root tips were found in the maxillary arch. Dividing the mouth into four quadrants, the retained roots were distributed as follows: upper right, eighty, or 42.6 per cent; upper left, sixty-one, or 32.4 per cent; lower right, twenty-five, or 13.3 per cent; lower left, twenty-two, or 11.7 per cent. (Fig. 1.) One can readily see from these curves that fewer roots remain in the mandible than in the maxillae.

One reason for the greater number of

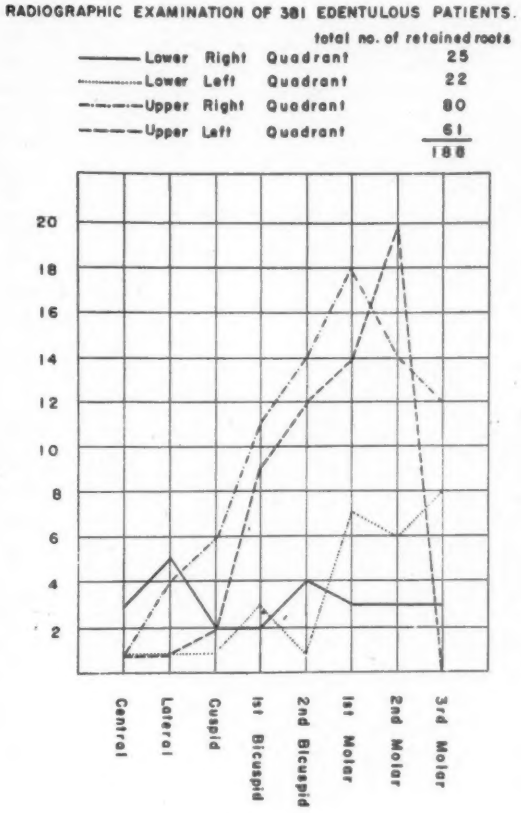

Figure 2.

root tips in the maxillary arch may be the fact that there are usually six more roots in that arch than there are in the mandibular arch. This would increase the number of possible fractures. The roots of the maxillary teeth are also smaller in circumference, have less bulk and are therefore more fragile. Another reason is that visibility is usually better in the mandible.

One would expect fractures of roots to be more numerous during operations upon the posterior teeth. In the maxillary arch, the distribution of root tips closely substantiates this idea since 47 per cent of the retained roots were first and second molar. The areas around the upper third molar contained only a few retained root tips, probably because its roots are shorter and are frequently fused. (Fig. 2.)

SUMMARY

These figures represent a survey of retained roots in 381 dentulous patients who have had extractions outside our clinic. It was found that one out of every three of these patients had at least one root tip remaining. Seventy-five per cent of the root tips were found in the maxillary arch, the majority being posterior teeth. Of all the root fragments, 9.6 per cent showed areas of radiolucency.

CONCLUSION

There can be no doubt that x-ray films should be made before extraction and that care should be taken at that time to assure complete removal of the whole tooth. All retained roots should be removed if they are accessible without too great a sacrifice of overlying tissue or penetration of vital structures such as the maxillary sinus. Many of these roots have no pathologic significance and perhaps may never have, but since the x-ray film cannot determine the presence of infection or its significance, the only safe procedure is elimination, when practical. For patients who are old and have worn dentures previously without discomfort, and for those having root tips enclosed in apparently healthy bone well below the cortical plate, surgical intervention may be unnecessary. Naturally in those cases in which surgical measures are to be taken, care should be exercised in order that the shape of the ridge shall not be altered materially. When roots are permitted to remain, the matter should be explained so that the patient will be aware of their presence. A definite rule in regard to the removal of these roots cannot be made. Their treatment must be left to clinical judgment and experience.

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CHEMICAL STERILIZATION OF INSTRUMENTS

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THAT satisfactory sterilization of surgical instruments is a problem for which no complete answer has been obtained is indicated by the multiplicity of solutions and preparations promoted for this purpose. Chemical sterilization affords many conveniences, such as ease of application, freedom from corrosion or from exposure to heat and greater simplicity of apparatus or equipment required. Boiling instruments, or sterilizing them at higher temperatures in autoclaves, is apt to draw their temper and to cause increased rusting and dulling of the edges of cutting instruments. The corrosion of iron, steel and copper is the result of the formation of oxides, promoted by the presence of oxygen and acids. Aluminum instruments, on the other hand, are relatively resistant to acids and oxidation, but are readily attacked by alkalis. In addition, if instruments made of more than a single metal are immersed in a solution that contains an electrolyte, there may be created an electrolytic cell or battery that speeds up the process of corrosion by transfer of the metal in response to electromotive forces. Because of these facts, it has been difficult to devise a solution which would be both an effective sterilizing agent and non-corrosive.

Some of the corrosion may be avoided by using alkaline solutions. There are on the market certain preparations to which sodium hydroxide or other common alkalis are added for this purpose. However, if the quantity of sodium hydroxide is great enough to provide the buffer power needed to neutralize the carbon dioxide absorbed from the air, the alkalinity is too high, causing irritation of the skin and corrosion of aluminum instruments. Sodium hydroxide, therefore, is undesirable as an alkalizing agent. Another method of preventing corrosion is the addition of a reducing agent, such as sodium nitrite, which overcomes the oxidizing power of atmospheric oxygen. Other reducing agents could doubtless be used, but the cheapness of the nitrite, and its ready availability, have diminished the search for more effective or desirable substitutes.

The common antiseptic agents, such as the chlorine derivatives, boric acid, or borates, the mercurials and the phenols, all are slow or ineffective in concentrations that can be employed, or else are unduly corrosive. Dilute alcohols are fairly effective, although their speed of action and reliability are not so great as might be desired. Formaldehyde is one of the most effective antiseptics, and, not being an electrolyte, is relatively free from chemical reaction with the various metals used in instruments. However, in the presence of ammonia, which is another possible alkalizing agent, it forms methenamine, which is inactive as an antiseptic. In the presence of strong sodium hydroxide, it tends to form paraformaldehyde and other inactive polymers, producing unsightly precipitates and weakening the antiseptic potency of the preparation.

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The present study was undertaken with the object of developing a sterilizing solution that could be used for chemical sterilization of instruments in medicine and dentistry. Such a solution should contain inexpensive and readily available ingredients and be equally applicable to instruments made of all metals without producing electrolytic cells and having other corrosive effects. The solution finally developed as a result of this study satisfies these requirements. It is reported also to be effective in epidermophytosis, "athlete's foot."

METHODS

The method used for studying corrosion was immersion simultaneously, in both open and closed vessels containing the solutions, of steel razor blades and copper and aluminum wire that had been cleaned of all grease or varnish. These were observed for rusting or other evidence of corrosion from time to time over periods of at least three months.

The bacteriologic tests were made with *Staph. aureus, Esch. coli* and *Cl. welchii,* and the spores of *B. subtilis, Cl. botulinum* and *B. anthracis.* Twenty-four-hour broth cultures were used of *Staph. aureus* and *Esch. coli. Cl. welchii* spores and *Cl. botulinum* spores were used from a brain medium. *B. subtilis* and *B. anthracis* spores were used from agar slants, only cultures showing large numbers of spores being selected. The culture on the slant was washed off with saline solution (0.85 per cent sodium chloride) to obtain a suspension which was used to contaminate the metal surfaces. In all cases, either the organisms or the spores were cultured after the test to prove that the results were not invalidated by a spontaneous loss of viability of the organisms.

The main antiseptic test, designated as the strip technic, consisted of using thin metal strips (1 by 5 cm.) of aluminum alloy, chromium plated on one side. The surfaces were originally cross-hatched with scratches to roughen them, but, after the first few preliminary trials, there was sufficient corrosion of the surface to give a mossy appearance and a large surface area. This surface was comparable to that of the metal on a corroded surgical instrument. Each strip was pierced by a hole at one end, through which was tied a short piece of waxed dental floss on which was a small metal hook. The length of this thread was such that, when the hook was hung on the lip of a test tube containing the culture medium, the strip was partially immersed, the thread being left dry. Before each trial, the strips were placed in glass tubes and autoclaved, together with blotting paper and the other sterile materials required. Wires were fastened across the mouths of fruit jars of 1-quart capacity, which, after sterilization, were used as drying jars. When in use, the mouth of each jar was covered by a sterile Petri dish.

In the actual testing procedure, each strip was taken from its sterilizing container by catching the hook in a sterile inoculating loop. The strip was then partially immersed in the broth culture or suspension for a moment without wetting the supporting thread. The strips were next withdrawn from the culture and any drops of liquid removed by blotting with a sterile blotter. The strip was then transferred to the drying jar and covered with a sterile Petri dish. By means of a curved glass tube, a current of sterile air, which had been cleansed by passing through sterilized columns of glass wool and cotton, was passed to the bottom of the drying jar.

The metal strips were dried in the air stream for from ten to twenty minutes, so that the culture medium and organisms were firmly fixed to the surface by drying the protein film from the medium. About eight strips could conveniently be inoculated and placed in the drying jars at one time. After drying, these strips were exposed to the antiseptic solution

for definite periods of time by immersion, the whole strip and part of the supporting thread being covered. Then the strips were dried again in the same sterile air current in order to remove traces of the antiseptic, which might have subsequently inhibited growth. Each strip was then transferred to a tube of nutrient broth, and hung from the lip of the tube by the supporting hook, the inoculated part of the strip but not the thread being immersed. Incubation was continued at 37° C. for seven days or more. If there was any doubt about growth, subcultures were made. In all cases, when growth was seen, morphologic and cultural identity with the originally inoculated organism was established.

In all trials, the following controls were used: 1. An inoculated control strip was not directly exposed to the antiseptic, but was subjected to all the other procedures that would influence the viability of the inoculum, including exposure to the vapors of the antiseptic in the second jar. This strip was then placed in broth and incubated. In all trials, heavy growth was present within twenty-four hours. 2. A sterile strip was immersed in the antiseptic and transferred at once to broth, carrying with it as large a quantity of antiseptic as would adhere. The broth was inoculated with one loopful of the culture used in the trial. Prompt (twenty-four hour) growth of the organisms was taken as evidence that the largest possible quantity of antiseptic that might be carried over by this strip in the experimental trial would not inhibit growth in the volume of medium used. All cultures and suspensions of spores were made homogeneous before use by shaking with fine glass beads.

The second method, called the subculture method, which was used in some of the tests, was capable of greater quantitative accuracy as to interpretation of results, but did not reproduce, to the same extent, the practical conditions of using the solution. One cubic centimeter of the culture suspension was placed in sterile test tubes to which was added 10 cc. of the antiseptic solution being tested. One-loopful samples of the mixture were taken at intervals and made into nutrient-agar pour plates. These plates were incubated and observed for one week and the number of colonies recorded. One-loopful samples of the antiseptic mixture were found not to transfer bacteriostatic power to the agar pour plates. However, when 0.1 cc. of this antiseptic solution was transferred in this way, bacteriostatic effects were observed.

B. anthracis would not grow after it had been dried on the metal strips. Therefore, with this organism, large dental burs were used, being fastened to bent pins with dental floss. The burs were not blotted after they had been dipped into the suspension of the spores, but were dried in the glass jars as with the strips and then hung in the antiseptic solution in the usual way. These were then removed, dried in a stream of air and put into the nutrient broth to determine the viability of the spores after the treatment. This, therefore, duplicated conditions of the strip test, except that the metal was steel and of different shape and larger amounts of culture and antiseptic were held and dried in the interstices of the bur.

For each determination in all procedures, a sufficient number of time intervals and duplications of the tests were used to give a satisfactory degree of reliability to the conclusions. When the results, because of irregularity or technical reasons, appeared unsatisfactory, the experiments were repeated until the difficulties were overcome.

RESULTS

Solvents.—The two solvents that would naturally be considered are water and alcohol. Water has the disadvan-

tages of promoting corrosion and rusting and of being devoid of intrinsic antiseptic action. Alcohols, on the other hand, if anhydrous, will not cause corrosion and will act as slightly effective antiseptics. Ethyl alcohol suffers from the defect that its optimum antiseptic action requires a 70 per cent concentration, and the efficiency rapidly decreases as the concentrations deviate from this strength. It is also subject to restrictions of the laws concerning alcoholic beverages, which, with beverages in the pure form, impose a high tax, or necessitate using special solutions, denatured by the addition of foreign materials. Isopropyl alcohol has certain definite advantages that caused its selection for our mixture as the main solvent. It is not used as a beverage, and therefore is not subject to legal restrictions, and does not have to be used in denatured form. It is readily available as a by-product of the petroleum industry, at a cost that, before the outbreak of the war at least, was only about 40 cents a gallon, which makes it cheaper than ethyl alcohol of the same grade of purity. It has the additional advantage that its optimum antiseptic efficiency is obtained at a 50 per cent concentration. Therefore, a smaller amount of isopropyl alcohol is needed than of ethyl alcohol in order to get the same degree of antiseptic power.

In our antiseptic tests, 50 per cent isopropyl alcohol in water killed *Staph. aureus* in less than ten seconds, but failed to kill *B. subtilis* spores in forty-eight hours, when tested by the subculture method. No improvement in the antiseptic power of the alcohol was obtained by increasing its concentration, since a 90 per cent strength failed to kill *Staph. aureus* in two hours. Anhydrous isopropyl alcohol was completely ineffective as an antiseptic, and even prevented the action of added formaldehyde in the form of 8 per cent strength of formalin. This showed that the presence of some water is necessary for the antiseptic action of both the alcohol and the formaldehyde. Since the need of moderate amounts of water for the antiseptic activity of these compounds is a matter of common knowledge, further discussion of this is not necessary.

In the presence of the 50 per cent isopropyl alcohol, there was a rapid and marked rusting of the steel instruments. The next problem was to prevent the corrosive action and, at the same time, develop a greater degree of antiseptic power. One commercial solution referred to in Accepted Dental Remedies avoids part of the difficulty of corrosion by reducing the water content of the solution to not more than 15 per cent. To do this with isopropyl alcohol would seriously interfere with the antiseptic power of the alcoholic solvent, and thereby reduce the potential sterilizing capacity. For this reason, we chose rather to develop a method of obtaining sterilizing power and anticorrosive effects by diluting the alcohol with an equal part of water. This had the additional virtue of economy.

Reducing Agents.—Sodium nitrite is commonly used as a reducing agent to overcome the oxidative effects of atmospheric oxygen in solutions of this type.[1] We tested the anticorrosive action of 0.1 per cent sodium nitrite in our solution and found that it diminished the amount of corrosion for three or four weeks, but some rusting developed thereafter, especially on steel instruments. For this reason, it was decided that a content of 0.2 per cent sodium nitrite would be more effective, and this concentration was used thereafter, with satisfaction.

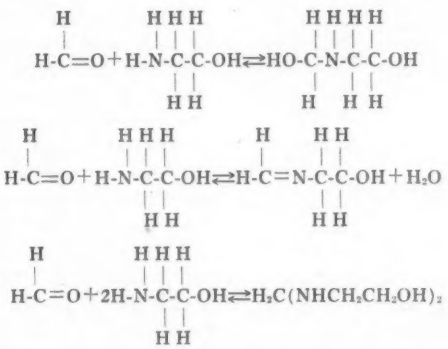
Alkalis.—The reducing action and the pH are two factors which cannot be separated completely, since they are mutually dependent and both are important in controlling the degree of corrosion. Ordinary caustic alkalis, such as sodium hydroxide and potassium hydroxide, have been commonly used to

alkalize sterilizing solutions and thereby avoid corrosion by acid. These agents are undesirable and impractical for aluminum instruments, since they form partly soluble aluminates with this metal and etch the surfaces. They also may confer on the solution a rather high degree of alkalinity, which makes it caustic and irritating for the skin and, hence, somewhat undesirable. Ammonia, another possible alkali, is unsatisfactory for use with a formaldehyde solution, since it forms hexamethylenetetramine, which is inactive as an antiseptic. In addition, ammonia is sufficiently volatile to give off unpleasant vapors, and therefore is less desirable for cold sterilizing solutions.

A cheap and readily available organic alkali is morpholine, which, in a 10 per cent strength in the presence of nitrite and isopropyl alcohol, prevented all corrosion for more than three months. Other possible alkalis are the three ethanolamines that have become available at moderate prices. Both triethanolamine and monoethanolamine, when used in conjunction with sodium nitrite, were found to prevent corrosion, for the three months' period of observation. They had the further advantage that, being weak alkalis, they did not corrode the aluminum instruments, and all three metals tested could be present in the container at the same time without difficulty. There was practically no choice among morpholine, triethanolamine and monoethanolamine. However, monoethanolamine was selected for the final trials because, theoretically, it would have the highest alkali content and be the most efficient neutralizer. Later, it was discovered that the monoethanolamine on the market contains variable amounts of triethanolamine, and also probably diethanolamine, so that the triethanolamine could have been used.

Monoethanolamine reacts with formaldehyde to form condensation products according to any one of the accompanying three equations.[2]

The reactions appear to be reversible, because, when the free formaldehyde was removed from solution by chemical reaction, as in the phloroglucin test, quantitative color values for the total amount of formaldehyde present were obtained, indicating that free formaldehyde had been made available from the combined formaldehyde.



Antiseptic tests with 7 per cent monoethanolamine in water by the subculture technic showed slight inhibition of *Staph. aureus* after forty minutes of exposure, but immersion for twenty-four hours did not kill the spores of *B. subtilis*. As it did not increase the antiseptic power of 50 per cent isopropanol over that of isopropanol alone, no part of the antiseptic action of the mixture could be

ascribed to the ethanolamine. These alcoholic solutions of ethanolamine felt soapy on the skin, but were not caustic, as would be the case with the same concentration of one of the metallic hydroxides. With the large amount of total alkali that could be introduced into the solution by the use of tolerated amounts of ethanolamine, loss of available alkali through absorption of carbon dioxide from the air was obviated and freedom from corrosion assured.

Antiseptic Agent.—The choice of the antiseptic agent was more difficult than was that of the solvent or anti-oxidative agents. Mercury compounds would be theoretically useful, since they are powerful antiseptics and have a strong bacteriostatic action in very high dilutions. Preliminary tests quickly showed that mercuric chloride was totally unsuited for this purpose, because its use caused prompt corrosion of the metals. Mercuric potassium iodide solution also proved unsatisfactory, since the metals were badly corroded within twenty-four hours after immersion. Certain poorly ionized organic mercurials were then tested in the hope of obtaining a compound in which the concentration of the mercuric ion was not high enough to cause damage. Mercury salicylate and mercury oxycyanide were in this group. However, because the mercury plated out on the copper and aluminum, these mercurials could not be used. The two well-known commercial organic mercurials, metaphen and merthiolate, were also tested similarly. They caused less corrosion than did the other mercurial compounds, but, even so, there was appreciable deterioration in the metal surfaces within less than a week. Hence, useful solutions of these organic compounds could not be prepared.

SUMMARY OF THE ANTISEPTIC ACTIONS OF THE PROPOSED STERILIZING MIXTURE*

Organism	Time of Exposure for Bactericidal Effect	Time of Exposure for Partial Inhibition of Growth
Staph. aureus	20 seconds	
Esch. coli	10 seconds	
Cl. welchii vegetative forms	1 minute	
B. subtilis spores	130 minutes	120 minutes
B. subtilis spores (different strain)	300 minutes	240 minutes
Cl. botulinum spores	240 minutes	180 minutes
B. anthracis spores	30 minutes	15 minutes

*Tested on dental burs for B anthracis and by the "strip" technic for other organisms.

An organic compound that is effective against certain types of higher organisms is propylene oxide, but it has not been commonly used as an antiseptic agent. No corrosion was caused by this compound in 90 per cent isopropyl alcohol, sodium nitrite and triethanolamine. However, the antiseptic power of this combination was lacking, since two-hour immersion, using the strip technic, failed to kill *Staph. aureus.*

The compound finally decided upon for the main antiseptic effect was formaldehyde. This is so commonly used that its mode of antiseptic action need not be discussed, except to state that it is germicidal rather than bacteriostatic. It precipitates proteins and hardens surfaces, possessing an astringent action in addition to sterilizing effects. When 3 per cent formaldehyde was used in an almost water-free mixture consisting of 4 per cent triethanolamine and 95 per cent isopropyl alcohol, *Staph. aureus* was not killed within two hours. When the alcohol concentration was reduced to 50 per cent by adding water, the staphylococci were killed within twenty seconds, as demonstrated by the strip technic. This solution was made by using an 8 per cent solution of formaldehyde, U.S.P., which would correspond to an absolute concentration of about 3 per cent formaldehyde. This same strength of formaldehyde in water alone did not kill all the organisms within two

minutes, when tested by the subculture technic. Against *B. subtilis* spores, the same strength formaldehyde killed in forty minutes, when water was the solvent, but in less than ten seconds when 50 per cent isopropyl alcohol was used. Therefore, the alcohol in this concentration definitely potentiated the mixture.

Inasmuch as ethanolamine reacts with the formaldehyde, it was necessary to determine whether the antiseptic power of the formaldehyde would be completely abolished in the presence of an excess of ethanolamine, or whether the chemical complex formed was also antiseptic. Seven per cent monoethanolamine by volume exceeds the amount needed to react with all of the 3 per cent formaldehyde in the solution. With the subculture technic, 3 per cent formaldehyde in water required two minutes to kill 99 per cent of *Staph. aureus*. When to this was added 7 per cent monoethanolamine, fourteen minutes was required to kill the same proportion of these organisms. With *B. subtilis* spores, the same mixture only inhibited the organisms after twenty-four hours of exposure, whereas the formaldehyde in water killed in forty minutes. It can be seen, therefore, that the monoethanolamine-formaldehyde reaction product was less effective as an antiseptic than was the free formaldehyde in pure solution, nevertheless the former possessed some antiseptic power.

In an additional test of the possible antiseptic power of the monoethanolamine-formaldehyde reaction product in the presence of alcohol, special solutions of the 3 per cent formaldehyde and monoethanolamine, and of a combination of these in stoichiometrical proportions, each in 50 per cent isopropanol, were used. To each solution were added 0.2 per cent sodium nitrite and the volatile oils described farther on. Tests were made with the subculture technic against *Staph. aureus* and *B. subtilis*. All the solutions, including one of the alcohol alone, killed *Staph. aureus* in less than twenty seconds, the shortest exposure tested. Thus, this organism contributed no information on the activity of the reaction product. However, with *B. subtilis*, the subcultures showed no restraint of growth in the alcohol alone, or alcohol plus ethanolamine, after forty-eight hours' exposure; whereas they were sterilized by the solution containing free formaldehyde within six and one-half hours. The solution containing the reaction product, but no free formaldehyde, did not completely sterilize the cultures after forty-eight hours of contact, but its presence caused a marked reduction in the number of colonies. Apparently, therefore, the formaldehyde-amine reaction product, in the presence of 50 per cent isopropanol, was less effective as an antiseptic than in aqueous solution, but still had some slight activity.

These results indicated that it was not desirable to have all the formaldehyde in the solution in combined form, even though this made the mixture relatively odorless. The proportion finally decided upon was a compromise consisting of 3 per cent monoethanolamine with 3 per cent formaldehyde, obtained by adding an 8 per cent solution of formaldehyde, U.S.P., by volume, which gave a residue of free formaldehyde plus a considerable amount of the combined formaldehyde-ethanolamine complex as a buffer and possible reservoir of formaldehyde action.

Surface Tension.—It is an accepted principle of bacteriostasis that compounds with low surface tension often are able to exert antiseptic action more effectively than when the surface tension is high. This is because the low surface tension facilitates wetting and adsorption on surfaces in increased concentrations. To determine whether this phenomenon might be used in the present solution, a sulfonated detergent known as aerosol was added in 1 per cent con-

centration to the final solution, described farther on. The antiseptic potency of this aerosol-containing solution was tested by the strip technic on spores of *B. subtilis, Cl. botulinum* and *B. anthracis*. However, the potency was not improved by the addition of this surface tension lowering agent. Measurements of the surface tension of the solutions with DeEds' surface tension tubes[3] showed that the aerosol did not reduce the surface tension to a significant degree below that already obtained by the ethanolamine-formaldehyde-alcohol mixture. This fact was an adequate explanation of failure to increase the antiseptic potency by this means. Therefore, aerosol was omitted from the final solution.

Odor.—Since a concentration of monoethanolamine, which was sufficient to neutralize the odor of formaldehyde in the solution, interfered with its antiseptic efficiency, it was necessary to leave some free formaldehyde in the mixture and to blend the odor with a suitable perfume. After trials with various volatile oils, an inexpensive and effective combination was developed by using 0.1 per cent oil of rose geranium and 0.2 per cent oil of cinnamon or cassia. The synthetic or simulated oils are satisfactory in case the natural oils are not available or not preferred because of cost considerations. These particular oils make a bouquet of odor with the formaldehyde which almost completely disguises the antiseptic. The odor is also heavy enough that, when the sterilizing container is kept closed, there is little or no odor discernible in the room air under ordinary conditions of usage.

Final Formula.—The formula as finally developed for an acceptable antiseptic mixture has the following composition (totaling 2,010 cc.):

Isopropyl alcohol	1,000 cc.
Oil of rose geranium	2 cc.
Oil of cinnamon (or cassia)	4 cc.
Distilled water	780 cc.
Sodium nitrite	4 gm.
Monoethanolamine*	60 cc.
Solution of formaldehyde U.S.P.	160 cc.

The ingredients are mixed in the order given, to avoid overheating. If the formaldehyde is not fresh, there may develop within the first few days, after mixing, a slight precipitate of the polymers of formaldehyde. The polymerization products, after they have been separated out, can be filtered or strained off, leaving a solution that will remain clear indefinitely. The solution can be colored, if desired. The pH of this mixture is 8.8 as measured with a glass electrode. If the same volume of triethanolamine is substituted for the monoethanolamine, a pH of 10.5 is obtained. This has a definite soapy feeling on the skin.

ANTISEPTIC POWER

Bacteriologic tests with this mixture, using various aerobic and anaerobic organisms in the vegetative and spore stages, have been made with the strip technic. The results are summarized in the accompanying table. It is seen that the mixture killed typical pyogenic organisms, both aerobic and anaerobic, in less than one minute, when in the vegetative stages. Spores required longer immersion, but, after several hours, were destroyed.

Practically identical bactericidal and sporocidal results were obtained in separate tests with the proposed mixture containing triethanolamine instead of monoethanolamine. In all probability, the efficiency and speed of sterilization of spores was at least as good with this mixture as it is in the usual boiling water sterilizer, since only pressure sterilization at elevated temperatures can be relied on to kill all spores more quickly than does this mixture.[4] Use of the autoclave for most instruments may

*Or triethanolamine, which is more readily available commercially than the product labeled monoethanolamine, since the completion of this report.

cause corrosion and loss of temper and sharpness of the cutting edges; hence, it is somewhat undesirable. Since this sterilizing mixture kills almost instantly the organisms of primary interest to users of instruments, it possesses sufficient sterilizing power and speed for effective routine use.

LOCAL APPLICATION ON SKIN

According to observations made by B. P. Davies, of the Stanford School of Health, the proposed sterilizing mixture can be applied to the skin either by being daubed on with a gauze sponge, or by use as a foot bath for from five to fifteen minutes with beneficial effects in epidermophytosis ("athlete's foot"). The first application should be made cautiously with the diluted mixture, if there are open raw areas, and only after previous test for the possibility of undue sensitivity. When such applications have revealed a satisfactory tolerance of the mixture, it may be applied in full strength, the feet or affected parts being soaked for as long as fifteen minutes, if this seems desirable. Such application has an astringent effect on moist surfaces, drying up the excess secretion, and, in addition, has a strong fungicidal action on the causative organisms. In this way, the mixture has been found to be effective in treatment of selected cases of this difficult condition. Applications should not be made longer than necessary, nor too frequently, and probably not oftener than twice weekly, since otherwise the skin may become too dry and irritated, and dermatitis will occur. The use of this mixture, like other antiseptics, should not be invariably relied upon, or abused, in this condition. However, it has been used routinely for this purpose with satisfaction for several years in large gymnasiums, where control of this infection is an ever-present problem. The ethanolamine presumably has a contributory action in the effectiveness of the mixture for this purpose, since this amine has been shown to have unusual detergent and penetrating powers for the skin, without causing irritation.[5] The details of the treatment and results obtained are to be reported separately by Dr. Davies.

DISCUSSION

The use of an alkalized alcoholic solution of formaldehyde as a cold sterilizing agent is not new. Spaulding[6] tested the relative value of various chemical agents on knife blades against both sporulating and non-sporulating organisms. He decided that formaldehyde solutions, containing either borax or alcohol, were preferable from the standpoint of antiseptic potency and freedom from corrosion. It would appear from comparisons of his data with ours that the proposed sterilizing mixture is more rapidly effective than the solutions studied by him. Blass and Styron[7] have more recently reported on a mixture containing formaldehyde, rubbing alcohol and sodium borate, for chemical sterilization. Sodium borate has not proved, in our hands, to be an adequate means of preventing corrosion of instruments. Nor, for reasons already stated, do we believe that ethyl alcohol is the best vehicle for a preparation of this sort. The general problem of determining the value of antiseptics and germicides for chemical sterilization has been considered by Knighton in a special report published by the Council on Dental Therapeutics of the American Dental Association.[8] Knighton concluded that the inadequacy of the chemical sterilizing solutions, previously described, against spores, makes it desirable to use heat sterilization wherever possible.

However, tests with our sterilizing mixture, which contains monoethanolamine or triethanolamine as a new ingredient in proportions balanced to obtain the optimum degree of activity, showed that spores can be killed reasonably quickly; that is, within time periods

that are probably shorter than those required for heat sterilization by boiling in the usual steam sterilizer. Against non-sporulating organisms, such as those commonly found on surgical instruments, the action is almost instantaneous. Therefore, it is believed that the proposed mixture is an effective and safe agent for sterilization of instruments under ordinary conditions.

When dirty instruments are put into this mixture, the fluid will need to be changed frequently because of the precipitated protein collecting in the container. In addition, the presence of blood, pus or other foreign material on instruments slows down the penetration of the antiseptic to the organisms below the surface and therefore diminishes the efficiency of sterilization. However, when the instruments are reasonably clean, immersion for from five to ten minutes in, and swishing or agitating the pieces for over-all contact with, the proposed mixture will kill the ordinary pyogenic organisms with a satisfactory margin of safety. Immersion for four or five hours will kill, in addition, even the most resistant spores. This, we believe, represents an adequate sterilizing power to make this mixture generally applicable wherever conditions are such that chemical sterilizing solutions can be used to advantage. Instruments should be immersed with the aid of forceps or some convenient device, and not by dipping with bare fingers. Frequent contact of the skin with the proposed mixture is apt to result in dermatitis.

CONCLUSIONS

1. A satisfactory antiseptic mixture for chemical sterilization of instruments contains formaldehyde dissolved in isopropyl alcohol, in which corrosion of instruments is prevented by the addition of sodium nitrite and monoethanolamine (or triethanolamine). Surgical and dental instruments made of steel, copper, aluminum and other metals in common use are not appreciably corroded even after months of continuous immersion in this solution. The mixture should not be diluted.

2. Common pyogenic organisms are killed by this mixture probably within one minute after immersion, and from ten to fifteen minutes' immersion ensures complete sterility against such bacteria. The most resistant spores tested are killed in less than five hours, a speed which compares favorably with that of other methods of sterilization, except perhaps autoclaving at elevated temperatures.

3. The proposed mixture has a less objectionable odor than the usual formaldehyde alcohol mixtures, because of the chemical combination of a part of the formaldehyde with the ethanolamine, and blending of the residual odor with selected aromatic oils.

4. Application by others of this mixture to the skin is said to be effective in the treatment of epidermophytosis. Application should be made cautiously to avoid undue irritation (dermatitis). These results are to be reported separately by others.

5. The proposed mixture has been used successfully as a chemical sterilizing solution for dental and surgical instruments, thereby avoiding heat sterilization and such undesirable effects as corrosion and dulling of cutting edges. Care should be used in handling the mixture, as frequent contact with the skin is liable to result in dermatitis. This can be easily avoided by indirect immersion of instruments.

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ROENTGENOGRAPHIC STUDY OF THE TEETH OF A GROUP OF DENTISTS

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IN making this study, advantage was taken of full-mouth roentgenographic examinations made of about 350 dentists of the State of Tennesse. The roentgenograms were taken during the course of the second annual postgraduate seminar given by the Tennessee State Dental Association in November 1940. The 350 dentists were from all parts of the state, and their ages ranged from 21 to 65. Fourteen intra-oral films were used in taking a full-mouth roentgenogram of each dentist. From the entire group of 350 full-mouth roentgenograms, 102 were selected as being satisfactory for this study. No bite wing or extra-oral films were considered.

Emphasis is placed on the fact that the study was based on this type of full-mouth roentgenograms and that it was not supplemented by any other type of examination, and, consequently, no claim is being made that all pathologic conditions were noted.

These full-mouth roentgenograms were mounted in 14-film cardboard holders and were studied before a regular viewing box for:

1. Number of teeth present. This is an actual count of the number of teeth present in 102 full-mouth roentgenograms, and the average number per mouth was secured by dividing the total number of teeth by the total number of full-mouth roentgenograms used.

2. Missing teeth. This total figure was arrived at by multiplying the total number of full-mouth roentgenograms by 32 and subtracting from this figure the actual number of teeth present. The average number of missing teeth per mouth was arrived at by dividing this figure by 102.

3. All metallic restorations, not including bridge abutments, present in the mouth. This included a count of the total metallic restorations as well as the number showing secondary caries about the margins.

4. All fixed bridgework. This included a count of the total number present.

5. Secondary caries. This included a total of secondary caries around metallic restorations including bridge abutments.

6. Primary caries. This included all virgin carious areas perceptible on the roentgenograms.

7. Pronounced general alveolar atrophy. Only those mouths showing marked bone loss in the occlusal or incisal to apical direction were so classified.

8. Pronounced local alveolar atrophy. Only those showing marked bone loss in

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the occlusal or incisal to apical direction, and that were not extensive, that is, those in which only a part of the arch was involved, were so classified.

9. Calculus present. Any calculus found anywhere in the entire mouth was considered sufficient to classify it as having calculus present.

10. Abnormal areas. These were divided into two classes. The first were abnormal areas of lessened density in connection with roots of teeth; the second, abnormal areas of lessened density not connected with the roots of teeth, but still in the mandible or maxillae.

11. Abnormal radiopaque areas. This included all areas in the mandible, maxillae or gingivae showing an increased density on the roentgenogram.

12. Unerupted teeth. This included all teeth still embedded beneath the soft tissue. Only one of this group was so placed that eruption was prevented, and therefore could be said to be impacted.

13. Supernumerary teeth. Any tooth present other than those of the normal complement were so classified.

14. Deciduous teeth. All deciduous teeth remaining in these mouths were counted.

15. Root fragments. All remnants of roots of teeth remaining in these mouths were counted.

16. Pulp stones. This included all areas of increased calcification in the pulp chamber or root canals that could be determined by the use of roentgenograms. Each tooth showing this type of change was counted as one in arriving at the total.

17. Root-canal therapy. Each tooth presenting evidence of having the pulp chamber or root canals filled was counted as one. Also included was a count of those presenting no evidence of pathologic change about the apices, and those giving evidence of abnormal change about the apices. The foregoing conditions are shown in condensed form in the accompanying table.

DATA DERIVED FROM ROENTGENOGRAPHIC STUDY OF TEETH OF 102 DENTISTS

	Number	Average per Mouth
Number of teeth	2,716	26.7
Missing teeth	548	5.3
Metallic restorations (not bridge abutments)	1,114	10.9
Metallic restorations with defective margins (not bridge abutments)	145	1.4
Metallic restorations with secondary caries	36	0.35
Fixed bridges	73	0.71
Edentulous areas without restorations	78	0.76
Bridge abutments with secondary caries	4	0.04
Secondary caries (total)	40	0.39
Primary caries	189	1.8
Pronounced general alveolar atrophy	37	0.37
Pronounced local alveolar atrophy	38	0.38
Calculus	67	0.67
Radiolucent areas in connection with teeth—abnormal	4	0.04
Unerupted teeth in mandible or maxilla—abnormal (not in connection with teeth)	12	0.12
Radiopaque areas—abnormal	16	0.16
Unerupted teeth	17	0.17
Supernumerary teeth	1	0.0098
Deciduous teeth	1	0.0098
Root fragments	1	0.0098
Pulp stones	225	2.2
Root canals filled	27	0.27
Root canal therapy with evidence of pathologic change	5	0.04
Root canal therapy—negative on roentgenograms	20	0.19

DISCUSSION

As a means of clarifying the figures given under the entry "Calculus," it should be noted that calculus any place in the mouth was sufficient for listing calculus as present. The teeth showing calculus were not counted, and, for this reason, the figures in the second column represent the percentage of mouths showing calculus rather than the average number of teeth per mouth showing calculus.

The average number of teeth per mouth is rather high considering the wide age range and the fact that among the 102 full-mouth roentgenographic surveys, there was one edentulous mouth examined. The highest number of single restorations in any one mouth was twenty, with an average of 10.9 per mouth. Of the seventy-three fixed bridges in 102 mouths, there were three bridges each in eight mouths. The longest span was one six-tooth bridge. Of the 189 primary carious areas, seven were seen in one mouth.

In a search of the dental literature, we found a similar study made on eighty-nine freshman students of a dental college.[1] The average age for this group would be obviously much lower than that for the group of dentists under consideration. This undoubtedly is a factor in some of the differences in the findings. As an example of this, our study reveals 5.2 missing teeth per mouth for the dentists against 1.9 missing teeth for the dental students. The dentists have 0.17 unerupted teeth per mouth as compared with 1.35 unerupted teeth for each dental student. The dentists have 0.27 teeth per mouth with root-canal therapy, while the dental students have 1.1 teeth per mouth with this type treatment.

Another study[2] of 765 patients who had examinations made at a dental clinic enables us to make the following comparisons with the dentists under consideration.

These patients had an average of 0.26 impacted teeth per mouth as compared with the extremely low figure of 0.0098 impacted teeth per mouth for the dentists. The same patients had 0.36 root fragments per mouth, as compared with 0.0098 per mouth for the dentists.

One other study,[3] dealing with 500 edentulous and partially edentulous mouths, gives us the opportunity to make the following comparisons: The 500 patients had 130 retained root tips. The 102 dentists of the present study had only one root tip retained. The 500 patients had a total of thirteen unerupted or impacted teeth as compared with a total of seventeen for these dentists.

CONCLUSIONS

1. The mouths of the dentists under study were in need of considerable restorative work.

2. Prevention of pathologic conditions such as alveolar atrophy is needed.

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SURGICAL TREATMENT FOR TRIFACIAL NEURALGIA

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TRIFACIAL neuralgia has baffled the surgical and medical world for many years. It has been defined as a spasmodic neuralgia of any or all divisions of the fifth cranial nerve. Long and arduous labor, involving many experiments and technics and much research, has been expended, to little avail. We are still searching for a satisfactory method of treatment.

Many men today contend that internal medicine will eventually supply the solution to this problem. Vitamin B complex has been extensively used, but with no definite proof of success.

To date, surgery has been of the greatest aid in trifacial neuralgia. The brain surgeons are given credit for permanent relief and the most successful treatment of this disease, by section of the posterior root of the fifth cranial nerve. This is a tedious and radical operation, requiring a great deal of experience and skill. The operation affords freedom from pain, but at the expense of loss of sensation of all of the areas supplied by this nerve.

I have noted, during the observation of many cases of trifacial neuralgia, that there is a definite localized point where the pain begins with each spasm. In many instances, this is in the mandibular area, traveling backward and upward to cover the entire side of the face and temporal area. In these cases, I maintain that resection of the posterior root of the fifth cranial nerve is far too radical.

I have seen L. L. Levy, of New Orleans, resect the mental nerve intraorally in a number of cases with excellent results. I have used this technic in many of my own cases and have found that it relieves the patient for a period of six months to one and one-half years. At the end of this period, the case calls for a second operation. This is a disadvantage, but the conservative procedure is preferable to the radical method, owing to the fact that very little of the area of the face is affected by loss of sensation, and the patient can leave the dental chair within half an hour.

I should like to present here a new technic for operating in cases of trifacial neuralgia that I have found very satisfactory. Because it was devised only recently, I have not yet been able to determine the duration of its palliative effect on the pain; nor do I know whether the pain will recur after a lapse of two or more years. However, according to the results in patients operated upon two years before this writing, it can safely be said that the pain will not recur for at least two years. The operation can be performed in the dental chair under local anesthesia, or on the operating table under intratracheal anesthesia, the latter being preferable.

The technic is as follows: A vertical incision is made through the mucous membrane and musculature, extending from the lower end of the anterior border of the coronoid process, along the anterior border of the ramus, but slightly medially or lingually and down to the area of the third molar. Care must

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be exercised not to extend the incision too far distally because of endangering the lingual nerve. Through the use of the dental periosteotome, the tissues are retracted from the ramus lingually, and thereby the lingual and mandibular nerves and vessels are exposed. With the aid of a suture carrier, a 00 chromic gut tie is looped around the lingual nerve, to act as a retractor, thus minimizing the possibilities of injury to this nerve. With a suture carrier, another loop is carried around the mandibular nerve as high as possible and tied tightly so that it will not slip. The nerve is then withdrawn slightly from the mandibular canal and severed at the mandibular foramen. The nerve is then severed again slightly above the suture. Approximately 2 cm. is removed, this leaving some distance between the nerve ends. The ties, from the mandibular nerve and the lingual nerve, are removed and the area is closed.

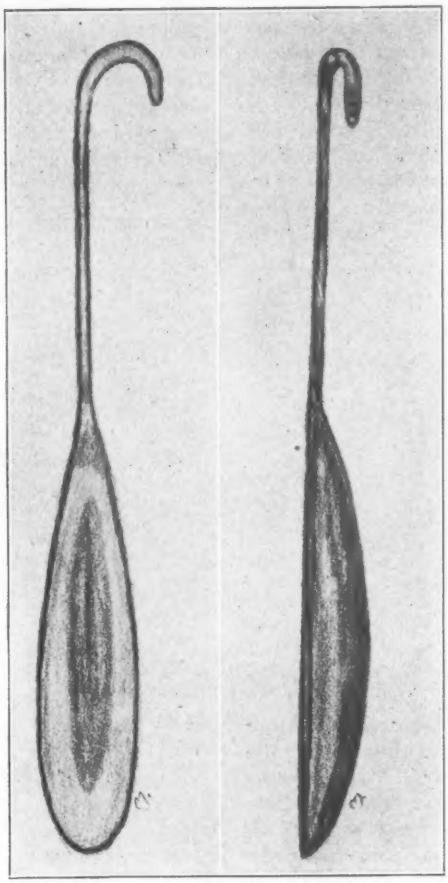

Fig. 1.—Anterior and lateral views of suture carrier.

No deep sutures are used in this operation. Only two interrupted superficial

sutures are necessary. The tissues are closed as in a linear incision.

From many observations, it is evident that the mandibular nerve regenerates rapidly in its course in the canal. While repairing more than 700 fractured mandibles, I found that, in more than 75 per cent of these cases, the mandibular nerve was completely severed or definitely injured. The percentage would be much higher had not the fractured condyles and those fractures of the ramus above the mandibular foramen been accounted for in this number. In every case, sensation returned within a few weeks, with the exception of one in which sensation did not return for six

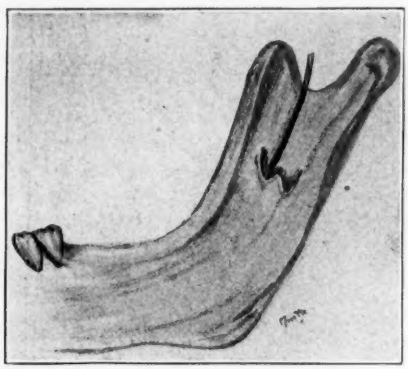

Fig. 2.—Portion of resected nerve (blackened area).

months. We have a fair idea of the regenerative powers of the mandibular nerve after its entrance into the canal, but there is no absolute way to determine the rate of reconstruction of the part of this nerve which lies between the ganglion and the mandibular foramen. There is no doubt in my mind that this is also a regenerative area, but I think regeneration may perhaps be much slower because there is no definite channel for the nerve to follow. This question, of course, is not to be debated, but to be answered by experiment.

While using this technic, I once was asked by a group of observers, "Why not use alcohol injections and spare the patient this surgical procedure?" The answer to this question is very obvious and clear in my mind. Upon reentering mental regions that have been injected with alcohol, I have found not only a mass of fibrous tissue in the area of injection and quicker nerve regeneration, but obliteration of the vascular tissue. This is not the case when surgical measures are employed. In one case, I also observed an extensive sloughing from the use of the alcohol injection method.

Following is a recent case history:

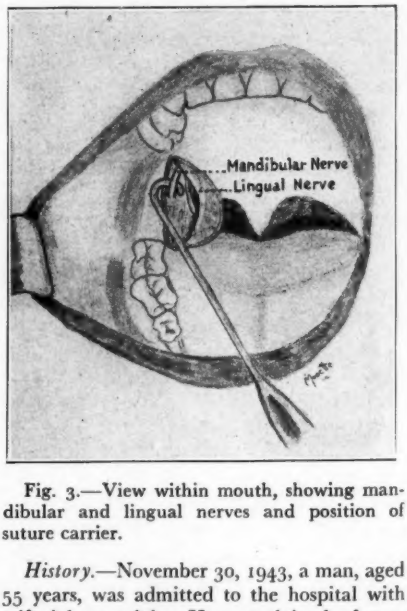

Fig. 3.—View within mouth, showing mandibular and lingual nerves and position of suture carrier.

History.—November 30, 1943, a man, aged 55 years, was admitted to the hospital with trifacial neuralgia. He complained of paroxysms originating in the mental region, the pain spreading posteriorly over the mandible and up into the region of the temporomandibular joint. Simultaneously, with the first pain, there was also a radiating pain over the left eye. All of the paroxysms were unilateral, occurring on the left side only. They persisted for about five or ten seconds, and then subsided completely.

Pain was first manifested about three years earlier, following extraction of all the teeth.

The paroxysms left the face in spasms. There was loss of sensation in the soft tissue of the nose and left cheek. Before an operation on the mental nerve, the pain was chiefly in the left maxilla in the region of the antrum. However, after operation, which consisted of resection of the mental nerve, two and one-half years before, there were no more paroxysms until a year before his present admission to the hospital. This pain, as described, originated and maintained itself chiefly in the lower jaw.

Since admittance, the patient had had almost continuous paroxysms. Cold, as provided by ice or water, acted as a "trigger" and a paroxysm would follow. There were, however, no "trigger points" on the face, but eating and talking initiated such pains. There was a burning sensation at first, then a "click," with a shooting pain running from the anterior mandible to the ramus, then radiating up over the ramus, the joint and the temporal area. After the paroxysms subsided, there was twitching in the retromolar fossa.

About five years before, the patient noted a weakening of his legs, which had become progressively worse, until he had very little, if any, control over them. There was a history of a fall and landing on the sacrum about a year before, with consequent loss of function of the legs.

Examination.—The patient was weak, pale and anemic and had the appearance of being undernourished. The patient complained of a cold, numb feeling in his extremities, and a throbbing when lying down in bed. He was unable to move his legs without great effort.

Operation.—December 4, under intratracheal cyclopropane anesthesia, an incision was made along the anterior border of the ramus of the mandible intra-orally on the left side. The tissue was reflected from the medial surface of the ramus and retracted, with exposure of the lingual nerve. A loose tie was carefully placed around the lingual nerve and used as a retractor. The mandibular nerve and vessels were then palpated with the index finger. With the aid of a suture carrier, a 00 chromic gut tie was placed around the mandibular nerve, which acted as a retractor, pulling the nerve away from the vessels and withdrawing it slightly from the mandibular foramen. This nerve was then severed at the mandibular foramen, and severed again above the tie, and thus approximately 2 cm. of the nerve was removed. The ties were removed from both nerves. The tissue was brought together and sutured with 00 plain gut.

Course.—December 5, the patient was resting well. There was complete absence of pain and edema and there was no soreness in the mouth.

December 6, he was discharged with an appointment to return to the dental clinic. At this time, he had suffered no pain and had an increased appetite.

December 9, the patient felt well, had had no pain and had gained in weight and color. He was discharged permanently from the dental clinic.

Outcome.—January 17, 1944, the patient was entirely free from pain, and had had no recurrence of the paroxysms. He sleeps and eats well and has gained more weight.

Trifacial neuralgia is a condition that should be subjected to many more experiments. Surgically, little more, if anything, can be done. The nerve endings and a portion of the nerve itself, as well as the posterior root, have been resected. However, this problem furnishes medical researchers a field with many interesting possibilities. Until it becomes possible to eliminate pain without operation, and without loss of normal sensation of the face, surgical measures must be granted first choice for these cases.

SOME PERIODONTAL PROBLEMS

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THE treatment of periodontosis presents many problems, because there is no known reason why the periodontal tissues of so many persons in apparently good health break down. The longer one practices periodontia, the more it becomes apparent that some persons are more liable to develop the disease than others; for, with the same known etiologic factors in two persons of the same age, periodontal disintegration will develop in one and not in the other. This applies to the progress of lesions also, for more advanced lesions frequently develop in patients about 16 years of age than in others over 30. Moreover, the same type of lesion in different cases varies in appearance.

To cite a few examples of cases that have come under my observation: A clinic patient 65 years of age had never brushed his teeth, and the gingivae, after a thorough scaling of the exposed calculus, healed and no pockets were found to be present. On the other hand, patients seen in private practice who have always brushed their teeth as carefully as they could, show advanced pocket formation. Many patients with an end-to-end occlusion have advanced periodontosis, while others with the same malocclusion have none. I have seen patients of mature age with diabetes whose periodontal tissues were hardly affected, while in others the lesions were marked.

Much progress has been made in the histopathology of the tissues concerned and in the treatment of end-results, but until the etiology is fully known, the profession must use methods of treatment now practiced and improve on them whenever it is possible. This paper will consider problems of treatment and endeavor to point out causes of failure, some of which have been discussed before. It not infrequently happens that different essayists present the same subject from a different angle, which serves to freshen facts in the hearer's mind that were not fully grasped the first time that they were heard.

I practiced dentistry as a general practitioner for about fifteen years, during a time when it was believed that periodontosis could not be treated successfully. In fact, students were taught that the duty of a practitioner consisted of cleaning the teeth of patients affected by the disease, whenever the latter asked for this service, and extracting the teeth later when mobility became marked. That this conception no longer exists is due to the progress that has been made in treatment methods, as has already been stated. From the experience gained during that period, much was learned about the problems of the general practitioner, and with it came an appreciation that, because his duties are so diversified, it is not an easy task to learn the details of all well. Moreover, because of this diversification, it is natural that some of his duties attract him more than others, but periodontia does not always seem to be one of them.

It has long been my belief, as I stated in an article in the February 1927 issue of the *Dental Cosmos*, that the inception of periodontosis occurs during early life.

Read before the Harvard Odontological Society, Boston, Mass., October 21, 1943.

McCall made a study of cases of young children observed in the Guggenheim Clinic in New York, a few years ago, and found many affected by it. As in all chronic pathologic conditions, the progress of the disease varies; which accounts for the fact that the symptoms are overlooked in some cases until middle life is reached. This delay in recognition is responsible for the misconception that the initial lesions are always found at this time.

The earliest symptom of cases of the horizontal type is hemorrhage of the gingivae, a visible sign; of the vertical type, a resorption of the alveolar process, which can be seen in a roentgenogram. The latter is more insidious than the former and is easily overlooked in the early stage. Chronic gingival bleeding in young patients should always be considered a forerunner of more advanced and deeper destruction of the supporting tissues, and all such cases should be treated until the hemorrhage is arrested. In the belief of many practitioners, the gingivae of some patients are softer than those of others and therefore will always bleed. This is not true, but as a consequence of the belief, the patient's complaint is ignored in some instances until he seeks the advice of a periodontist.

The periodontist sees cases which, if they had received proper treatment earlier, would never have come under his care. Cases coming to the periodontist may be divided into three groups: (1) those that have never been treated and are referred to him by the general practitioner who prefers to have a specialist assume the responsibility of treatment; (2) those that the general practitioner has treated without satisfactory results in spite of all his efforts, and (3) those that have never been treated or in which the patient has never been told that periodontosis has developed in his mouth. This group of patients seek the services of a periodontist without consulting the general practitioner, because of persistent gingival bleeding, an uneasy feeling in the gingivae or mobility of the teeth. They are usually referred by friends who have benefited by treatment. The two latter groups seek the periodontist because of some general practitioner's failure. One of the reasons for the prevalence of periodontosis is failure to recognize early cases, principally because pain is not a symptom of pocket formation and therefore there is no complaint by patients, although discomfort is sometimes experienced when the pathologic process is well advanced. The symptoms, therefore, differ from those of caries, which would be just as neglected, in many instances, if pain did not impel patients to seek the dentist for relief. Every general practitioner should be able to recognize early lesions because the treatment of this stage is comparatively easy.

There is no question that the performance of our duties demands manual skill. Unfortunately, this fact has created the impression, in the minds of some practitioners, that construction of plates and crowns, insertion of fillings, etc., indicates that ours is primarily a mechanical vocation. This conception is erroneous. As a parallel, the practice of orthopedics consists in part of the construction of metal braces and arch supports, but no one would think of regarding it as solely a mechanical vocation. It must be remembered that when a patient is treated for periodontosis, live tissues are involved and, because they possess life, they are subject to the same biologic reactions as all other body cells. Unless an operator keeps in mind the physiology and pathology of cell life, his treatment efforts will result in failure.

The conservative method of treating periodontosis is probably more commonly used than any other. According to many periodontists, the knife or electric cautery is used to remove the af-

fected soft tissues only when pockets are over 3 mm. in depth and in the bicuspid and molar region. Early cases and anterior teeth are treated conservatively because they readily respond to this kind of treatment, which simplifies what may be a complicated and unpleasant dental operation with other methods. Conservative periodontia has always been practiced by me and the problems discussed here will be considered on that basis. During this time, the great majority of patients were treated in private practice, the others under my supervision in the school clinics. As many of the former had been treated by general practitioners without success, the reasons for the failures were revealed as the case histories were learned. During the period that I treated periodontosis, when in general practice, what were accepted as remedies were used in a futile effort to check the disease in the belief that bacterial action was the underlying cause. However, after the profession found that these efforts were of no assistance and that bacterial action was a result and not a cause, other means were employed, which have proved to be satisfactory.

The fact that as many, if not more, teeth are lost from the ravages of periodontosis than from caries does not seem to be fully appreciated. This may be considered a broad statement, but the periodontist often finds himself in an awkward position when he tries to shield some practitioner and is asked to explain why the latter neglected to treat a patient who later came under his care. Some patients report that they have visited a dentist regularly at three or four month intervals. One seen recently said that she had done so every four months for twenty years believing that her mouth was being properly treated. It was found on questioning her that the treatment consisted of removing the visible calculus and cleaning the teeth. She was 41 years of age, and in good health, but the amount of bone resorption which the roentgenograms showed and the mobility of most of the teeth indicated immediate extraction. Every periodontist sees such patients more often than is realized.

Although research workers are able to produce periodontal lesions in animals by feeding them on a deficient diet, no one has definitely proved that a deficiency diet will result in periodontal disease in man; otherwise, treatment of the constitutional type would be a simple matter. Several years ago, in order to satisfy myself regarding the influence of diet on periodontal disease, I chose from the diet lists of patients in my practice a number that were carefully made; 101 to be exact. Each list consisted of twenty-one meals and everything eaten or drunk between them. The age, sex and all clinical symptoms were taken from their charts.

The analysis was made by a food expert in the Department of Agriculture in Washington, who recorded the component parts of all food eaten. The analysis was made during her spare time, and it was a year before they were received, so complete was the analysis. As far as I know, it is the only experiment of this kind ever carried out in private practice. The paper was read at a meeting of the American Academy of Periodontology in Detroit, and before our society later, and was published in THE JOURNAL as part of the proceedings of the Academy. It is referred to at this time because it should be of interest to those of you who did not hear the earlier presentation, since it is my intention to show some slides of the findings later. About five years ago, a research worker in the University of Minnesota asked if I would permit the gathered material to be used there as she wished to carry out a similar experiment in the clinic so that a comparison could be made of the findings. Her purpose was to prepare a paper for a master's degree comparing

the analyses, although, I believe, clinic patients and those in private practice do not always present the same dietary problems. Singularly, our final reports were alike. Her paper was published in the August 1939 issue of the *Journal of Dental Research*.

Among the services which seem difficult for some practitioners is occlusal grinding, because it is not well understood, being overdone, insufficiently done or not done at all. Teeth are sometimes ground, without success, to relieve occlusal stress which has resulted in pericementitis or neuritis. A patient, at one time, complained of severe neuritis, which prevented him from sleeping. The pain extended into his forehead along the path of the maxillary branch of the right fifth cranial nerve, but the practitioner was unable to determine the cause. An examination showed that the distopalatal edge of the maxillary lateral incisor was in close occlusal contact with a lower incisor. The edge was ground, with complete relief in a few days. This is only one of many cases that could be cited. Cases have been seen in which cusps of molars and bicuspids had been ground so much that the occlusal surfaces were flat. Nature never intended man to have teeth shaped in this way, as the resulting discomfort of the patients proved.

Regardless of all that has been written about Vincent's infection, the diagnostic symptoms are not always well understood. Profuse, spontaneous hemorrhage and a puffed appearance of the tissues are believed to be caused only by this disturbance, particularly when smears are sent to a laboratory for diagnosis and a positive report is returned on account of the number of spirochetes and fusiform bacilli found. The periodontist not infrequently receives cases for treatment with the comment that the condition has been diagnosed as Vincent's infection, but that the operator has been unable to check the hemorrhage entirely or eliminate the microorganisms. Some have reported cases that had been treated for six months and longer. In many instances, since all cases yielded to the usual conservative treatment, it was concluded that the primary disease was periodontosis, which permitted the Vincent organisms present in the flora of all pockets to multiply. In my opinion, this explains one of the causes of recurrent cases: the inflammation present in periodontal pockets, if not entirely reduced, may cause reinfection at a later period, unless the deep subgingival deposits and other irritants are eliminated. The other reason for recurrence of this disease is failure to insist on gingival massage by the patient after the symptoms have been eliminated. It goes without saying that a high tone of body cells will resist bacterial invasion.

Frequently, patients are seen whose gingivae are swollen and, when touched, bleed profusely, although there is no ulceration of the interdental papillae. A smear will disclose the presence of spirochetes and fusiform bacilli and, because of this, the cases are called chronic or subacute Vincent's infection. This, it seems to me, is incorrect because, I believe, there is no such condition as chronic or subacute Vincent's infection. Vincent's infection is essentially an acute disease, and ulceration or necrosis is a predominating symptom, regardless of all others mentioned. In Vincent's description, the disease was designated as an acute, ulcerative gingival condition, and any textbook on bacteriology will furnish the information that spirochetes and fusiform bacilli present in large numbers in blood smears taken from the gingivae multiply only after some other microorganism has invaded the blood stream. Moreover, they are found in other mouth disturbances. A few years ago, I stained and examined a number of blood smears taken from cases of periodontosis before treatment in which there

was a loss of gingival tissue and marked inflammation and found that some could not be distinguished from true Vincent's infection cases under the microscope, because of the large number of spirochetes and fusiform bacilli present.

Spontaneous hemorrhage is not an uncommon complaint in periodontal disease. Sometimes, the flow of blood is so profuse that it wakes the patient from a sound sleep, and he is compelled to rinse the accumulated blood from the mouth. This symptom is not infrequent in Vincent's infection cases also. Unless many cases of both diseases have been treated, it is not uncommon to infer that the condition is always due to Vincent's infection. However, an acute onset of the symptoms and ulceration, in addition to the presence of large numbers of spirochetes and fusiform bacilli, make a conclusive diagnosis. To these may be added ropy saliva, fetid breath, a slight degree of fever and tenderness of the submaxillary glands in some instances; none of which, with the exception of a fetid breath, is a symptom of periodontosis.

Whether radical or conservative measures are employed, success of periodontal treatment depends on the maintenance of gingival massage afterward, and the problem involved is to impress the patient with the importance of this fact. I have seen cases with tissues reinfected —cases that had been treated surgically by good operators known to me—simply because due care had not been taken to maintain oral hygiene and massage. The results obtained by surgical measures present marked contrast with the original condition but, it would seem, some operators neglect to follow up their results by persistent, repeated advice as to the necessity of this measure.

When a dentist fills a carious area, caries is not recurrent if the patient keeps the teeth clean; but, in order to maintain permanent health of the periodontal tissues, the patient must keep the mouth more than reasonably clean, with scrupulous efforts to stimulate the tissues because of the presence of micro-organisms in the oral flora, ever ready to attack the gingivae again if the cell resistance is lowered. It is this difference between the filling of a carious area and periodontal treatment that is responsible for the failure of some patients to cooperate as they should, too much dependence being placed on the practitioner's efforts and not enough on their own. Some patients assume that when the treatment period is ended, the gingivae look well and there is no visible suppuration, the all important part of the service rendered is over, regardless of the fact that, as they had been told explicitly, the health of the tissues depends entirely on home care. As a consequence, when the patient returns for a periodical check-up, the gingivae do not look so well as it did when treatment was concluded, and the periodontist is compelled to give a warning of the ultimate outcome of the neglect. Carelessness is responsible for this lapse. Fortunately, these patients are in a minority. Nevertheless, they are a problem to the dentist who has done his best to rid their tissues of disease.

In order to stimulate the gingivae, the brush bristles should be very stiff. Unless they are, the pressure exerted against the capillaries will be insufficient. Some dentists advise patients to use medium stiff or even soft bristles as they believe that very stiff bristles will injure the soft tissues or cause it to recede. This is also a misconception: any bristle will injure the soft tissue if not used properly. The correct application of the brush against the gingivae will cause the tissue to blanch as the sides of the bristles are pressed against it, and, when the brush is removed from the area, the flow of capillary blood is accelerated, bringing fresh oxygen in the hemoglobin to the gingival cells, beneficial not only to them, but also to the deeper tissues. The

teeth always become brighter because of the supply of this nutrient.

Gingival massage is not different from massage in other parts of the body, and any one who has been under the care of a masseur knows that firm pressure is used during the operation. It is my custom to furnish brushes to patients and to send others by mail every three months, because if brushes are used for a longer period, the bristles become soft when wet and, as has been stated, soft bristles are useless for the purpose of stimulation. It is for this reason that brushes used in the morning should not be used at night. It was learned by experience that patients cannot be depended on to purchase new brushes when they should, because they do not always remember how long brushes have been in use. Moreover, some patients have the idea that a toothbrush should be used until the bristles loosen or become worn. Supplying the brushes has proved to be very satisfactory. Patients should be taught massage at the first appointment for periodontal treatment and the importance of home care should be emphasized. The best way to teach them is to demonstrate the method at the chair,* using a large mirror to demonstrate just how massage should be employed. Verbal instructions are unsatisfactory.

The rubber point now used as an extra massaging agent has proved to be valuable as an accessory to the toothbrush. The use of powders and pastes to assist in maintaining mouth hygiene is not necessary. My patients have used a normal saline solution for over twenty years and the results have been very satisfactory. They have proved conclusively that the kind of brush and the manner in which it is used are the important factors in keeping teeth clean and bright looking and the tone of the gingivae high.

CONCLUSION

One reason, in addition to those already given for the prevalence of periodontal disease, is the attitude of some members of the profession toward the outcome of treatment. They discourage patients by telling them that periodontosis cannot be successfully treated. This harmful information, which is frequently passed on from one lay person to another, permits the ravages of the disease to progress unchecked. The reason for this situation is the poor results that the practitioners have had in treating patients, a dislike for treating patients affected by periodontosis and occasionally the results that they have seen in the mouth of a patient treated by a periodontist, after the patient has failed to return for a periodical check-up as instructed. These patients neglect to carry out instructions about mouth care and place the blame for the recurrence of the disease on the operator. Unfortunately, the practitioner does not have an opportunity to see those patients who have been treated and have carried out instructions.

Time will not permit a discussion of other problems such as occlusal habit neuroses and improper prosthetic restorations.

358 Commonwealth Avenue.

USE OF VINETHENE AS AN ADJUNCT IN NITROUS OXIDE-OXYGEN ANESTHESIA FOR DENTAL SURGERY

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GENERAL anesthesia for general dental practice has been shunned by most practitioners as involving too much risk, with the feeling that the results do not warrant the effort expended. Too many men simply refer cases requiring general anesthesia to specialists, not realizing that alleviation of pain is probably the most important single factor in building up a patient's confidence in the dentist.

We do not say that every patient desiring a general anesthetic should be given one in a private office without any further consideration. Most dental surgical procedures can be performed under local anesthesia, but it should be possible for the adequately trained general practitioner to care for those few selected cases in which general anesthesia is indicated. Besides the contraindications for general anesthesia in office practice, which have been so thoroughly discussed in many other articles and texts, there are several other points that must be taken into consideration in the administration of this type of anesthesia in general practice.

First and foremost, the person administering the anesthetic should be thoroughly trained, both theoretically and clinically, in the administration of general anesthesia. Since Horace Wells, a dentist, introduced general anesthesia, we must not lose our heritage and drop out of this field because of inadequate training. Many dentists have adjacent offices, and there is no reason why one cannot anesthetize while the other extracts. Since the general practitioner is not so well trained in dental surgery as the specialist in this field, he should not attempt involved procedures which would consume a great deal of time, under general anesthesia. The necessary equipment for administration, emergencies and recovery should, of course, always be present.

The main reason for this fear of general anesthesia in general office practice is the untoward reaction of patients during the induction phase. Attempts to shorten this period, which is the bugaboo of so many men, have led to the so-called rapid-induction method. With this technic, the amount of oxygen administered is cut down to almost nothing, in some cases to nothing. The patient then receives 100 per cent nitrous oxide. Many men still use this method in spite of a great deal of evidence as to the dangers involved. Courville[1] has reviewed accidents occurring with nitrous oxide-oxygen anesthesia and has shown examples of fatal results with the rapid induction technic. True, many men still use this method with comparative safety, but the absence of ill-effects may be ascribed to the short duration of the anesthesia.

Arrowood[2] states, "Since it takes ten to fifteen minutes for full saturation with a given mixture of nitrous oxide, oxygen deprivation during these short pro-

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cedures is not often sufficiently severe to be fatal." But it takes only one minute of oxygen lack to produce histologic evidence of permanent damage to the brain cells.[8] Although the residual air present in the alveoli of the lungs contains oxygen, we cannot afford to work with such a low margin of safety as is afforded by the so-called rapid-induction method. Another point against this technic is that a false excitement phase may occur during the first stage of anesthesia owing to the increased sensation of suffocation experienced by the patient.

Opposed to this method is the so-called "slow-induction" technic. With this method, an adequate supply of oxygen is always being administered to the patient. Chapman, Arrowood and Beecher[3] state that ". . . none of our patients retained consciousness beyond 75% nitrous oxide (with 25% oxygen), and most of them lost consciousness at 60% (with 40% oxygen)." Arrowood,[2] however, says:

> Some, but by no means all, patients can be adequately anaesthetized without premedication with this mixture (80% N_2O, 20% O_2) for simple extractions, if sufficient time is taken to saturate the patient. If this cannot be accomplished, nitrous oxide should be supplemented with a more potent agent in preference to further reducing the oxygen content of the mixture. Ether, vinethene, or pentothal is suitable for this purpose and selection depends upon conditions in each individual case. When it is recognized beforehand that the patient is likely to be resistant, premedication may make the difference between a stormy course and an uneventful one.

Most dentists are loath to employ premedication because of their fear of "hangover" effects. We deal with ambulatory patients, and depressant drugs are not generally used in ambulatory practice. How, then, can we obtain a safe, smooth, yet relatively rapid induction in an office patient without premedication? The slow-induction method offers a safe and fairly smooth induction, but the full effects may not be felt until saturation is reached (after from ten to fifteen minutes). Some patients cannot be anesthetized with nitrous oxide and oxygen alone unless the oxygen supply is cut dangerously low. Then, as Arrowood has suggested, we must use a more potent anesthetic agent as an adjunct. She suggests ether, vinethene (divinyl ether) or pentothal. The use of ether, because of its relatively slow excretion and untoward after-effects, is not feasible for office patients. Pentothal sodium has been recommended for dental office use by Hubbell,[4] but the relatively long recovery time and incipient dangers associated with its use have caused Mecca[9] and others to discourage its use for general office practice. Perhaps in time it will be developed into the ideal office anesthetic.

Vinethene, in my opinion, is an excellent adjunct to nitrous oxide-oxygen. It is quick-acting, relatively safe and rapidly excreted, with little or no after-effects. Wellman, Kable and Livingstone[5] found that only 2.6 per cent of patients vomited after its use, in contrast to the 57 per cent with ether.[6] Vinethene is, of course, not perfect. It is highly inflammable, cannot be stored indefinitely, causes increased salivation and may be dangerous in the hands of the inexperienced. Liver damage has been produced experimentally with vinethene anesthesia by Goldschmidt *et al.*,[7] but this has occurred only after prolonged anesthesia (two hours or more) and in the presence of anoxia. Wellman, Kable and Livingstone[5] list the following contraindications for vinethene anesthesia: "known or suspected hepatic damage; operations lasting over thirty minutes; the presence of a flame or sparking device; anuria, uremia or marked disease of the kidneys; paralysis of the vocal cords; ankylosis of the jaws; goiter; extensive disease of the lungs; diabetes; cyanosis; intestinal obstruction, and advanced debility."

Vinethene has been administered by the open drop method at Lincoln Hospital Dental Clinic since 1937 to an average of fifteen patients a week, mostly children. All induction for open drop ether anesthesia in the operating rooms is carried out by the use of open drop vinethene. We have noted a typical sequence of clinical signs in induction with open drop vinethene. The patient, usually a child, breathes the mixture according to the anesthetist's instructions for about a minute ("blow it away"). He then holds his breath for about ten or fifteen seconds. This is followed by a short period of slight hyperpnea, after which the patient lapses into the smooth regular breathing characteristic of vinethene anesthesia, third stage, first plane. The eyelid reflex is still present at this point. The patient is then ready for operative procedures.

For some time now, we have used vinethene together with nitrous oxide-oxygen for induction and maintenance in general anesthesia for exodontia and minor oral surgery at the Lincoln Hospital Dental Clinic. We use a Gwathmey model machine. This machine is not equipped with dials or gages, but with a wash bottle into which perforated metal tubes are inserted. The number of perforations through which the bubbles of the gases emerge into the water of the wash bottle denotes the proportion of the mixture being administered. We start with five "holes" of nitrous oxide and two and one-half "holes" of oxygen. A small wash bottle, into which one third of a bottle of vinethene is poured, is attached to the system. As the patient starts to breathe the nitrous oxide-oxygen mixture, the "dial" on the vinethene wash bottle is turned on and off two or three times, to allow vinethene to bubble through the water into the mixture. The patient's reactions are observed. One application of vinethene to the mixture is usually sufficient for induction. Occasionally, the patient may react to this bubbling of vinethene by coughing slightly. In this case, we wait a little longer before applying the vinethene admixture. The anesthesia can be maintained for as long as is necessary, which is usually not more than from ten to fifteen minutes, on this mixture of nitrous oxide-oxygen, with an occasional bubbling of vinethene.

We have used the same general method for major surgical procedures, such as appendectomy or hysterectomy, for induction in obstreperous patients. Here, a Waters' model is used. Ether is placed in the wash bottle and about 15 cc. of vinethene is placed in the drip apparatus. As the mixture of 750 cc. of oxygen and 7 liters of nitrous oxide per minute is administered, vinethene is dropped into this semiclosed system at the rate of about 40 drops a minute. Induction is usually sufficient by the time the vinethene is used up to switch to ether without any of the signs of pharyngeal irritation which usually accompany induction with ether. The induction is smooth, rapid and uneventful.

SUMMARY

Most general practitioners are reluctant to employ general anesthesia in their offices because of possible untoward effects during the excitement stage.

The rapid-induction method of reducing these occurrences is too dangerous for widespread use.

The slow-induction method is not always feasible with obstreperous patients without premedication.

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ACRYLIC TEETH AS A MEANS OF OBTAINING BALANCED FUNCTIONAL OCCLUSION IN PARTIAL DENTURE PROSTHESIS

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SINCE the introduction of synthetic resins to dentistry as a tooth restorative material, emphasis has been placed upon their use as inlays, jacket crowns, bridge pontics, etc., with little consideration, if any, of their use as a means of obtaining functional occlusion in partial denture and removable bridge prosthesis. Meanwhile, some investigators in this field of dentistry have come to feel that the resins may perhaps prove to have their greatest application in such work.

Establishment of functional occlusion by means of a partial denture is perhaps one of the most difficult of restorative procedures, and many cases have admittedly failed at this point. "Spot grinding" of porcelain teeth is, at best, only a close approximation. The use of the articulator as an aid in this process is limited, because of the difficulty of properly reproducing the irregular mandibular movements of a patient with a number of remaining natural teeth. This difficulty exists because the guiding cuspal inclines of these remaining teeth must determine to a great degree such mandibular movements.

A new approach to the problem of obtaining better functional relationship may be made more definitely by a technic utilizing teeth formed from any of the synthetic resins now available for tooth substitutes. This method permits a much more accurate restoration of balanced occlusion than ordinarily can be obtained with porcelain teeth. The technic consists of attaching to the appliance by means of a reinforcing framework especially designed for their retention wax patterns of the teeth to be supplied. When the patient executes the various possible movements of the mandible with the remaining natural teeth acting as guides, these wax patterns are "ground in" to a harmonious relation-

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ship with the opposing teeth. They are then reproduced in a synthetic resin.

No equipment other than that usually found in the average dental office is required. At present, the greatest advantage is an increased accuracy. The time now consumed is about the same as that needed for the usual method employing porcelain teeth. With further work, it is hoped that the technic may be simplified still more, in order that an actual saving of time may result.

The preliminary steps of constructing the appliance are the same as customarily used. The mouth is prepared, the occlusion of the remaining natural teeth

Fig. 1.—Model ready to be reproduced in suitable casting investment. The stone master model has been surveyed and the design of the framework determined and unusable undercuts have been blocked out.

is balanced if necessary, the impression taken and a master model constructed. (Fig. 1.) This model is then surveyed and the casting investment model is made by duplication. The first variation from the accepted technic is made in the wax pattern. The eventual position of the teeth to be supplied is determined with the aid of articulated stone master models, and a pattern of the framework which is to support the teeth is waxed to position. (Figs. 2 and 3.) Care is exercised to keep this framework well within the expected limits of the teeth, so that no difficulty will be encountered in contouring and shading them.

It should be noted that a separate framework is prepared for the retention of the acrylic saddle. There is also a temporary reinforcement, when necessary, near the anticipated buccal and lingual peripheries of the acrylic saddle. This reinforces a wax saddle which is used to support the patterns of the teeth when they are carried to the mouth for "grinding in" and is removed at the time that the base material is being processed. The extreme rigidity of chromium casting alloys permits the use of 18-gage

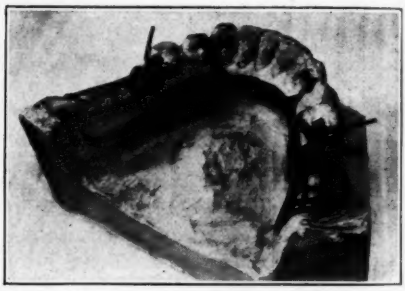

Fig. 2.—One method of providing retention of acrylic teeth to partial denture appliance, illustrated by wax patterns, consisting of loops lying within resin. There is also a bar to retain the denture base material.

wax forms for all of these reinforcements, while, with gold alloys, 16-gage forms are often necessary except around the periphery, where 18-gage will suffice.

The casting of the appliance is then made and finished as usual. All of the framework to be enclosed within the tooth or saddle resin is left rough ground, this finish being obtained with an ordinary heatless stone. It has been found that metal with a rough surface like this does not show through resins as readily as a highly polished one, which reflects all of the light coming upon it.

The appliance is next placed in the mouth, in order that its fit may be determined. If the fit is satisfactory, a registration of the centric relationship of the arches is made. A simple, accurate method of obtaining centric relation is as follows: Temporary wax saddles are first formed, so that there will be a firm tissue support for the wax bite-blocks during the actual registration. The master-model is lubricated with a solution of glycerin and water (or a similar medium) in the regions that will be covered by the wax saddles, and a thin layer of special hard wax is painted or flowed over these areas and around the reinforcing portions of the framework, care being taken that the appliance is

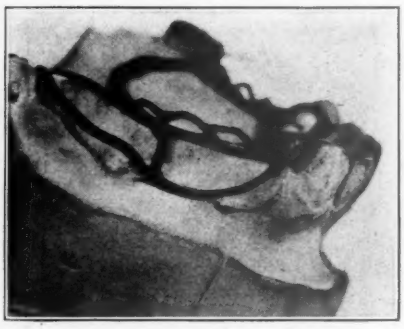

Fig. 3.—One method of providing retention of acrylic teeth to partial denture appliance, illustrated by wax patterns, consisting of loops lying within resin. There is also a bar to retain the denture base material.

firmly seated upon the supporting teeth. More wax is added with a brush or spatula until there is sufficient bulk for strength. These wax saddles can be removed easily with the appliance, if the master model has been properly lubricated.

It is recognizable to any one contemplating the use of this technic that these temporary wax saddles must be made from a wax which is extremely hard and which resists flow and fracture.

Baseplate wax is then used to form bite-blocks upon the wax saddles. These bite-blocks, which are left slightly above the plane of occlusion, should be sufficiently thick in buccal-lingual dimension. (Fig. 4.) The center of each bite-block is heated deeply with a hot spatula until it is molten, while strips along the buccal and the lingual sides are left as firm as possible. Thus, the molten wax is prevented from flowing. When the center wax has congealed slightly, the appliance is inserted in the mouth and the patient is instructed to open and to close the jaws several times. The appliance is then removed from the mouth and the wax chilled.

It is well to trim this impression of the opposing teeth, leaving only the occlusal one-third to the wax bite, so as to

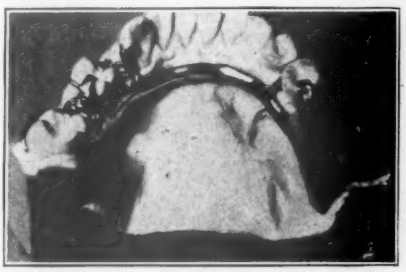

Fig. 4.—Framework with baseplate wax biteblock attached. The appliance is next taken to the mouth for registration of the centric relationship of the arches.

permit a better view in seating the occluding model. The appliance is then returned to the master model and a stone model of the opposing arch is supported in its proper relationship in the wax bite.

The models so related are then mounted on an articulator. (Fig. 5.) The bite-blocks are removed and, with a spatula, a hard inlay wax is flowed around the framework designed for the teeth. This hard wax, which is used for its greater strength, is built up short of occlusal contact. A softer inlay wax is then added to build the patterns up to the required occlusion. The alinement is

then determined and the buccal surfaces are carved to completion. The teeth of the opposing model are lubricated and warmed in a flame, and the articulator is closed. Inspection of the wax at this time will disclose a number of facets beginning to form. It is better to build the patterns up to an adequate occlusion at this time by adding wax carefully as the facets begin to appear than to carve them down from an excess of wax built up before the articulator is closed. The occlusal structure of the wax forms is then roughly carved, using the facets as guides. With the remaining natural teeth to guide the articular, lateral mandibular excursions will aid in this carving. One should see to it that no deficiency exists in the wax pattern during these movements.

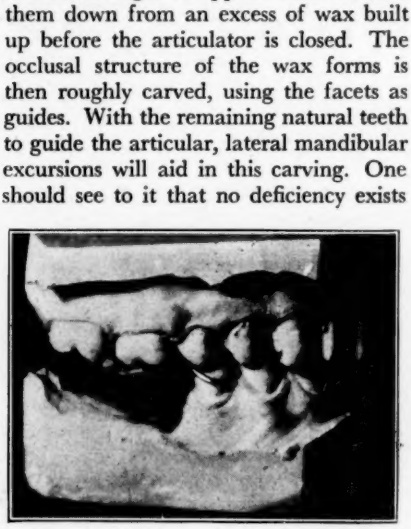

Fig. 5.—Stone model of upper arch positioned in wax bite. The models are ready to be mounted upon a suitable articulator.

The appliance with the attached tooth patterns is taken to the mouth at this time and centric relation checked and corrected, if necessary. The appliance is then placed in the mouth, and the occlusal surfaces of the wax teeth are softened by several blasts of warm air. The patient is instructed to move the mandible through all possible excursions. The tooth patterns are then dried, and examination under a good light will show a refinement of the facets taking place. These facets may now differ somewhat from those obtained with the articulator, since the exact mandibular movements peculiar to the patient are now aiding in their production.

It may sometimes be necessary to add wax in places which are not in functional relationship and to repeat the "grinding in" process, in order to refine the facets to a greater efficiency. The occlusal form may be modified at this time and the buccal alinement checked. Spillways and fossae are deepened as desired in the finished teeth. (Fig. 6.)

When all carving is completed, the wax saddles are removed, care being taken to keep the cervical outlines of the wax teeth intact. This is done because, to date, the best results have been obtained by processing the teeth and the saddles in two separate operations. When the two are processed at the same time, it is very difficult to acquire a satisfactory cervical line of demarcation between the tooth material and the pink base material.

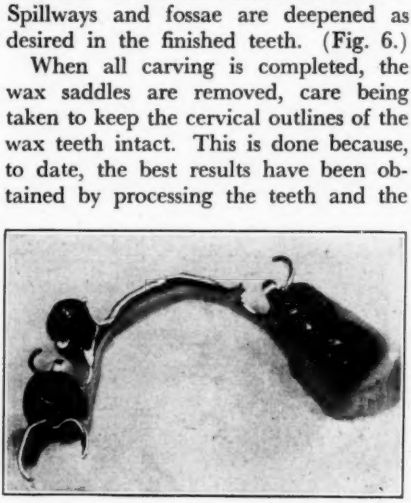

Fig. 6.—Wax patterns of teeth to be supplied after being "ground-in" by patient. The occlusal anatomic form has been carved to conform to the facets developed during lateral excursions of the mandible. The patterns will now be flasked and processed in resin.

The appliance, which is now ready to be invested, is placed in the lower half of a denture flask, with impression or model plaster for the investing medium. The buccal, occlusal and a small portion of the lingual surfaces of the wax patterns are left exposed. If possible, the buccal surfaces are placed at an angle of about 45 degrees. This is al-

ways true in a unilateral appliance, but when teeth are being processed on a bilateral partial denture, the appliance usually can only be flasked so that the buccal surfaces are converging or at least approaching the parallel. This attempt to obtain an angle of 45 degrees is made to lessen the possibility of undercuts which would interfere in opening the flask during test packing. The upper half of the flask is then poured in stone and allowed to set. It has been found that stone not only will impart the most satisfactory surface finish to the resin teeth, but also is much less likely to fracture from pressure exerted during packing. The flask is placed in warm water to soften the wax and is then separated. By this procedure, rather than boiling the flask, the wax does not become fluid and stain the plaster. Boiling water is then poured on the exposed wax until it has been removed. Any traces of color from the wax can easily be wiped away by cotton saturated with benzene.

Fig. 7.—Resin teeth after finishing process is completed. A temporary hard wax base may now be formed to the model preparatory to registering the functional ridge form.

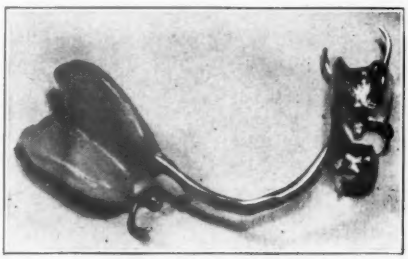

Fig. 8.—Functional wax impression of edentulous ridge obtained under normal biting stress by means of fluid wax of proper flow.

This process of investing allows the use of the displacement method of packing the resin into the mold rather than the injection method. We regard the injection method with disfavor for this type of work. Not only would multiple sprueing be necessary, but it would also be impossible to blend the cervical and incisal shades satisfactorily.

In the displacement method, the mold is completely filled with material of the chosen dentin color. After a test pack has been made, the enamel is placed over the dentin and test packs are repeated until the desired shade is obtained. Part of the dentin material will be displaced by the enamel and will be squeezed out at the junction of the two halves of the flask until the mold is just filled. When the shade is correct, a sheet of cellophane is placed between the two halves of the flask, and the teeth are processed.

It has been difficult to obtain a satisfactory shading of synthetic resin teeth. As the materials are now marketed, there is a premium upon individual ability to evaluate and match colors. There are some points of technic, however, which aid in developing the true shade. It is important to apply the enamel layer in such a manner that the teeth approach the desired shade from the direction of a darker color. If too much enamel is added and the tooth becomes too light, greater difficulty will be encountered in darkening the shade. The best way of doing this to insure an esthetic result is to remove all the material and to begin once more with the pure dentin color and add the enamel layers as before. If too many test packs are made, the material is apt to begin to harden, so that removal of the material in the mold and

the making of a new mix may be necessary.

It is also advisable to work with a mix of enamel which is thinner than the dentin mix. Rather than to add an excess of monomer (liquid) to the polymer (powder) to obtain such a mix, the enamel should be applied before the polymerization process has advanced to the point where the resin has become stiff. Use of enamel in this manner will allow better blending of the cervical and incisal shades owing to the fact that it can be placed in exactly the area where it is wanted and in approximately the desired thickness. It has been found that the enamel mix, when of the same consistency as the dentin, displaces the latter to too great a degree, overemphasizing the incisal color and giving too definite a line of demarcation between or insufficient blending of the two color zones.

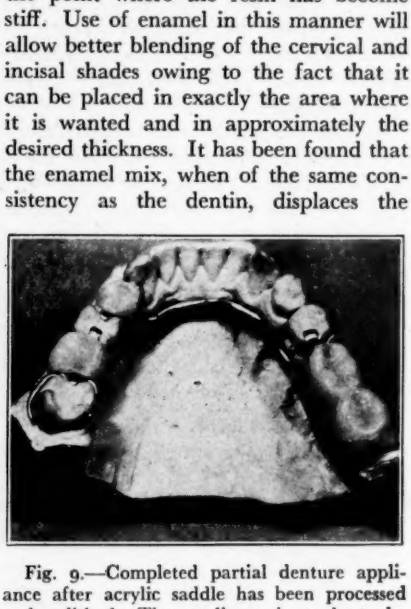

Fig. 9.—Completed partial denture appliance after acrylic saddle has been processed and polished. The appliance is ready to be delivered to the patient. It is necessary to cut away the ridges of the stone model in order to return the appliance to it after the functional impression.

In processing teeth on upper partial dentures replacing molar teeth on both sides of the arch, difficulty is often encountered owing to divergence of the buccal surfaces. Thus, when these cases are invested with the occlusal surfaces exposed, the buccal surfaces are diverging, this divergence causing the investment in the upper half of the flask to lock around the wax patterns. After the wax has been removed and the resin has been placed in the mold, it will be found that, whenever the flask is opened after a test pack, the investment will shear material from the buccal cusps. This makes the shade of the occlusal one-third to one-half of the buccal surfaces more uncertain, although usually good results can be obtained.

The most satisfactory method of handling this situation from the esthetic point of view would be to prepare each side of the arch separately. This involves two flasking, processing and unflasking operations, greatly lengthening the time involved. However, if the teeth to be supplied are conspicuous, this method could be used.

Fig. 10.—Wax bite strips used to determine masticatory efficiency at time partial denture is delivered to patient. Subsequent checks of this type will give a relative measurement of the wear on resin teeth.

In some cases, this problem has been met by investing the appliance so that the buccal surfaces of the wax patterns of one side of the arch are approximately vertical, allowing the upper half of the flask to be withdrawn smoothly. The patterns of the opposite side are invested so that only the occlusal surfaces are exposed. When the enamel is ready to be placed, the teeth of the one side of the arch are prepared in the foregoing man-

ner. On the other side, where the buccal surfaces are not exposed, a suitable instrument is inserted between the buccal plaster and the dentin material, forcing the latter away from the investment. While the resin is held in this position, another instrument is used to place a layer of enamel over the buccal surface. The dentin is then pushed back to place, and when the shade of the opposite side is correct, the teeth are processed. This method has produced quite satisfactory results, although it is an uncertain technic at best.

The processing of synthetic resin teeth is carried out in water. The exact time and temperature are determined by the directions of the manufacturer. It is important that teeth of this type never be processed under pressure in a vulcanizer or exposed to such conditions during the later processing of the base. It will be found that elevated temperature as from steam under pressure will destroy the color of the teeth, bleaching them almost white.

After the processing is completed, the flask is cooled in cold water or allowed to cool on the bench top. When it is cool, the flask is once more separated. If the appliance was invested at the proper angulation as described, no difficulty will be found in doing this. Moreover, a sheet of cellophane was left over the resin during the processing, just as one was used in the test packs. This prevents the resin from adhering to the plaster in the upper half of the flask. By means of a sharp knife or a vulcanite chisel, the investment is then carefully removed from around the appliance until it is released. This is a rather tedious and delicate task in that the clasps or other smaller parts of the appliance may be distorted by improper use of the instrument. It may be made easier by placing wax around these parts of the framework before investing. Then when the stone is being removed, there will be a slight space around each of the smaller units.

After the case has been removed, the teeth are ready to be polished. A tapered inlay finishing bur is used to remove the flash which will occur at the division between the two halves of the flask. Then flour of pumice and whiting are used sparingly with rubber cups and bristle brushes revolved at a low speed in the handpiece. On the important buccal and occlusal surfaces, no such polishing is needed, since processing against cellophane imparts a highly glossy finish to the resin, pumice being needed only on the lingual surfaces. (Fig. 7.)

Extreme care must be exercised in the polishing process or the object of the entire technic may be destroyed. The material wears away rapidly under pumice and the teeth may readily be taken out of occlusion by injudicious polishing. There is no reason for this to occur, if the operation is carefully performed.

The attempt is always made to limit the number of processing intervals to which the teeth are subsequently submitted during the attachment of the base material. However, even though this is confined to one operation when the appliance is being constructed, there may possibly be several additional rebases, if not repairs, during maintenance of the restoration. During each of these exposures to boiling water, the acrylic teeth will tend to lose their glossy finish and to become "frosted" even when thoroughly cleaned and carefully invested in stone. When this occurs, it is necessary to restore the finish with a wet rag wheel and whiting. Pumice should not be used. It is important that the rag wheel be kept wet and that the lathe revolve at a low speed when this polishing is done. If heat is generated, the resin will flow and wear away at an extremely rapid rate, with a resultant loss of occlusion.

The saddle of hard wax is then replaced as before described and the appliance is taken to the mouth so that the occlusion may be checked. A satisfactory

test is to have the patient bite firmly in centric position upon a strip of thin, soft wax. Occluding natural teeth should be able to perforate this wax approximately to the same degree as the acrylic teeth replaced. Tests in the functional ranges are made after the completion of the permanent saddle.

The base is then added by whatever technic desired. The patient is allowed to wear the wax saddles for twenty-four hours after they have been lined with wax. When he returns, a functional impression of the subjacent tissues is obtained within the wax saddles.[1] (Fig. 8.) The case is then invested and the saddles are processed in one of the synthetic base resins. (Fig. 9.)

After the appliance has been worn for a day or two, a check of occlusion in centric and functional ranges should be carefully made. This lapse of time will have allowed the appliance to become accurately seated, and experience has shown that, in a majority of cases, few if any adjustments will be necessary.

The physical properties of the synthetic resin now available for tooth restoration indicate that the materials will withstand the forces met in the mouth when they are used in the manner described.[2]

The water sorption and water solubility of the resins are sufficiently low, so that teeth made from such materials will remain clean and will not tend to disintegrate or to discolor.[2] The linear shrinkage which occurs during and after processing is approximately 0.3 per cent to 0.5 per cent.[2] It is obvious that such a small percentage of shrinkage will not affect restorations of this nature to any perceptible degree.

The yield, or elasticity, which resins display has been found to reduce materially the number of teeth fractured when the patient bites upon some hard foreign body. This property of yield is almost entirely absent in porcelain. The resins also have a property, elastic rebound, which allows some deformation without a complete permanent set or flow. The permanent flow is much less than that found in the ordinary amalgam alloy.[2]

The indentation or Brinell hardness of the resins is slightly below that of pure gold and pure silver, while a Bierbaum scratch test shows that they have a hardness similar to that of 22-carat dark alloy.[1] Results of clinical observations seem to indicate that the latter hardness is more nearly correct. Cases that have been in the mouth for from six to twenty-four months have not shown the tendency to wear and abrade which the Brinell hardness value would have led one to expect. Perfect occlusion has seemingly been maintained in these cases even when subjected to severe occlusal stresses.

This statement is in direct conflict with at least two articles which have been published in the dental literature of the past few months,[3, 4] John R. Beall, a research associate of the American Dental Association at the National Bureau of Standards, has presented data showing definite wear upon the acrylic resin teeth of two complete dentures worn by patients for four and for seven months.[4] No information is given as to the type of resin used or the method and time of processing, possible factors in hardness and resulting wear.

The method of obtaining these data from stone replicas made by duplication of the dentures seated upon stone models could possibly lead to error. If the hydrocolloid duplicating material was not handled perfectly, it is conceivable that the sagging, drying, wetting or tearing of the hydrocolloid could have caused what was apparently wear on the denture teeth.

In addition to this possible error, a second and more important cause of misinterpretation of the reported data must be noted as present. Unless the complete dentures possessed perfectly balanced occlusion when finally delivered, there

would be areas of cuspal plane interference during lateral and protrusive movements of the mandible. In porcelain teeth, these areas would usually result in discomfort to the patient, and for such areas of interference on acrylic teeth to wear or flow into a balanced relationship is a point in favor of the material. The uneven wearing of the teeth subjected to normal usage in this reported test might indicate that such a lack of functional balance had possibly been present.

The ultimate test of the wear and abrasion of acrylic teeth should be made when such teeth are attached to a tooth-borne appliance. This would eliminate the possibility of loss of appliance support with resulting settlement of the restoration and lessening of occlusal efficiency. If the teeth in such a case were constructed with balanced occlusion, as has been described, there could then be no doubt that any change in them would be due to wear. This is true because there could have been no possible change in the occlusal relationship of the teeth from settlement of the appliance. It is also believed that to attempt to determine abrasion and wear accurately by selecting a point upon the buccal or lingual surface of a tooth and measuring the cusp height from that point is extremely difficult.

A simple method of obtaining a relative measurement of the distance between the teeth of the upper and lower arches during mastication is to place a strip of 28-gage soft wax between them and to have the patient move the jaws from centric position through the lateral excursions. A comparison of such wax strips obtained when the appliance is delivered with others made at a later date will show any change in masticatory efficiency.

Figure 10 shows such a wax bite strip made two years after the delivery of an upper tooth-borne appliance and a lower unilateral extension or cantilever restoration. While this cannot be construed to prove lack of wear, since no such record was made of the occlusion when the cases were placed in the mouth, it does show that an adequate functional balanced occlusion is still present after two years. In only one molar area is there any possible loss of masticatory efficiency. This is upon the posterior tooth of the extension saddle, and, since no rebase has been made during the two years of use, it is probable that the change is in the supporting tissues rather than in the tooth; or it is possible that the functional efficiency was never so good here as in the rest of the appliance. There is seemingly no evidence of wear in areas where acrylic teeth oppose acrylic teeth and where acrylic teeth oppose natural teeth in this case.

An important advantage of using synthetic resin teeth is that there will be no fractures, as so often encountered with porcelain teeth during the processing of the resin saddles. In this technic, the problem of the drifting of teeth during processing of the base is also eliminated, since the teeth are firmly attached to the framework of the appliance. This also makes it possible for the partial denture to be worn by the patient temporarily without danger of the teeth becoming dislodged, as would be the case with porcelain substitutes.

This method of construction of a partial denture is doubly indicated in mouths where the vertical dimension of the arches has been diminished, very little space being allowed for the placement of the teeth to be supplied. Here, synthetic resin teeth will function very satisfactorily, whereas porcelain teeth ground thin enough to afford proper occlusion in such mouths would frequently fracture. The use of chromium alloy to cast the teeth for such appliances has been avoided because of the probability of occlusal trauma due to the extreme hardness of the alloys. That this might be an objection is borne out by the fact that the Brinell hardness of some of the newer

chromium alloys intended for inlay and bridge work has been reduced. The use of gold alloys for the construction of teeth in closed bite cases adds too much weight to the appliance, especially in maxillary extension cases wherein the dislodging effect of gravity is constant. The resins are not objectionable from either of these standpoints.

In areas where one or two teeth are being supplied by the partial denture apart from the saddle areas, the use of synthetic resin teeth has been found to be a great improvement over employment of the various facings and tube teeth. A special reinforcement is cast with the framework in these cases and the same technic follows as has been described. Such teeth may be processed at the same time as the teeth in the saddle areas or separately, according to their lateral or buccal inclinations.

When porcelain teeth are to be used in the saddle areas, it is still profitable to use the described technic to supply these additional one-tooth and two-tooth spaces. The task of grinding a tube tooth or a facing to place is eliminated, this making it easier to obtain occlusion in such places and preventing undue breakage.

In solving the problem of repairs of partial denture appliances, acrylic resin teeth have proved very helpful and, if used only for repair work, the material is valuable in any dental office. The repair of fractured wrought clasp arms has been facilitated by the use of such teeth. The artificial tooth next to such a fracture is removed whether it is porcelain or acrylic. A clasp wire is positioned in its correct relation to the abutment tooth and allowed to extend into the space created by removal of the tooth. Wax is then flowed around the wire and an inlay wax pattern of the tooth to be supplied is built up and carved, "ground in" and processed in acrylic resin. It has been found that a clasp wire so united to the appliance functions to a very satisfactory degree. This is a much easier and less expensive process than to tripod the appliance, to solder the clasp wire in place and to reset the teeth—a difficult task at best.

In repairing fractured tube teeth, experience has shown that better results may be obtained by undercutting the framework in that area and replacing the porcelain with resin. It is also possible to replace fractured porcelain denture teeth by this technic, when adequate retention can be obtained. This eliminates the difficult task of grinding a new porcelain tooth to occlusion.

From the foregoing, it may be easily recognized that one of the most fertile fields for use of the synthetic resins is partial denture prosthesis. In the construction of new appliances and in the repair and maintenance of others, the resins have much to offer in the nature of increased accuracy and simplification. It must be acknowledged that, in many instances, the resins do not constitute a substitute for porcelain, but are rather a new material offering possibilities of greater service to the patient than is offered by any other dental material.

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ACTINOMYCOSIS: REPORT OF CASE

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ACTINOMYCOSIS is a specific chronic infectious disease caused by *Actinomyces bovis*, the ray fungus. This organism has been demonstrated in the mouth and gastro-intestinal tract of apparently normal individuals. It has been isolated[1] from carious teeth, gingival tissues, tonsillar crypts and salivary calculus. It is strictly a parasite and cannot survive outside the host for any great length of time.

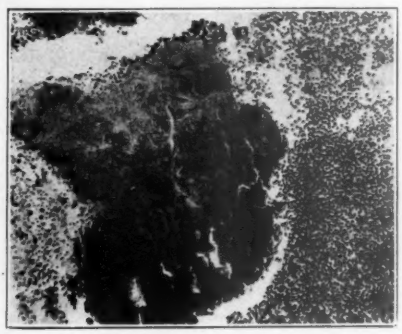

Fig. 1.—Low power photomicrograph of section of granule.

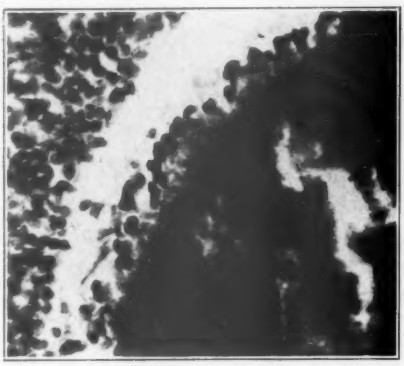

Fig. 2.—Higher magnification of section shown in Figure 1, depicting rodlike formations.

Despite its ubiquitous distribution, infection by the organism is rare, and seems to depend on traumatization of tissue, plus a lowered resistance of the host and perhaps a sensitization of the host to the organism. There must be, however, numerous instances of *Actinomyces bovis* being present in a traumatized area of low resistance, with no infection ensuing.

The ray fungus forms colonies of thin branching filaments, non-motile, non-spore bearing and non-acid-fast. It is anaerobic. In the body, a colony is recognizable as a small, yellow or grayish "sulfur" granule. Microscopically, there is seen the gram-positive central mass of filaments of the much-branched mycelium. Peripherally, there is a radial arrangement of large, rodlike forms with clubbed, gram-negative ends. With hematoxylin and eosin, both the filaments and the clubs stain dark blue. (Figs. 1 and 2.)

The morbid changes in tissues that are invaded by the ray fungus begin with edema, continuing to destruction of tissue, chronic suppuration and abscess formation, as well as attempted limitation of the process by a peripheral zone of granulation tissue. The infection is disseminated by continuity, through the blood stream and, in cervical and facial involvement, via the lymph channels.

The mortality from this disease is high. There is no specific treatment, al-

though success has been reported with various therapeutic procedures. Complete surgical excision of the diseased part gives the best results. The systemic administration of iodides, copper salts and, more recently, the sulfonamides, and irradiation with the x-rays have all had some success. Treatment is therefore somewhat empiric, and often a combination of these methods may prove to be useful.

Approximately half the cases of actinomycosis occur in the cervicofacial region. The mouth serves as the chief portal of entry. Usually, it is only after a chronic, draining infection has failed to respond to ordinary therapeutic measures that actinomycosis is suspected.

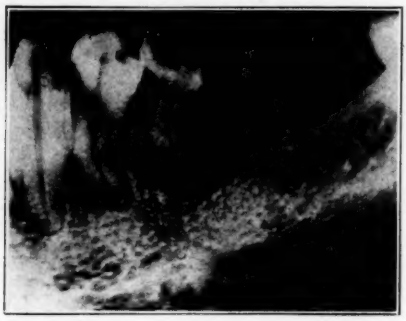

Fig. 3.—Condition on January 20, 1937; showing pulpless second bicuspid, caries extending to pulp and periapical and distal radiolucent area.

By the time that the diagnosis is confirmed, the lesion is beyond the stage where a complete surgical excision can be performed without extensive mutilation. And so a tedious and uncertain course of drug and radiation therapy is prescribed. It would be much better for the patient if the lesion had been discovered at an early stage, before the tissues could break down and begin extensive suppuration. In this respect, the case report which follows presents an interesting and thought-provoking solution.

REPORT OF CASE

History.—D. N., a white woman, aged 28, entered Sea View Hospital in October 1936, with an admission diagnosis of chronic unilateral tuberculosis, clinical symptoms having been first noted five months previously. The sputum was strongly positive for acid-fast bacilli (Gaffke VI). Serologic studies showed the Wassermann reaction to be negative. The hemoglobin was 69 per cent, with 3,850,000 red blood cells, 15,500 white blood cells and a differential count of 82 per cent segmented polymorphonuclears, 12 per cent lymphocytes and 5 per cent monocytes.

Pneumothorax was instituted and treatment was maintained until the sputum became negative, in April 1937, and continued until the end of November, when the patient was discharged with the pulmonary tuberculosis arrested and, to all intents and purposes, cured.

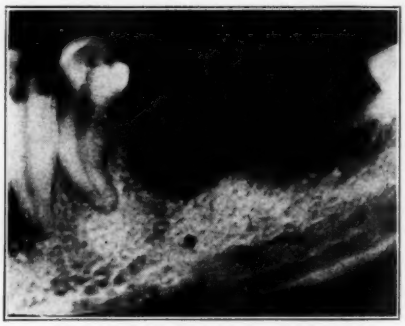

Fig. 4.—Appearance January 22, after extraction of tooth and removal of granuloma from alveolus.

Examination.—In the routine course of treatment, the patient was sent for a dental examination and consultation. The teeth and jaws were roentgenographed, January 20, 1937, and it was discovered that the mandibular left second bicuspid was pulpless, with caries extending to the dental pulp, and a large circumscribed periapical and distal radiolucent area. (Fig. 3.) There was also present an extensive subgingival involvement.

Operation.—Under procaine anesthesia, the tooth was extracted, the granuloma curetted from the alveolus and a gauze dressing placed in the socket, January 22. The roentgenographic picture at this time is shown in Figure 4.

Laboratory Report.—Microscopic examination of the granulation tissue section revealed that it was the usual type, composed of fibroblasts, lymphocytes, histiocytes and dilated capillaries in a collagenous matrix. In addition, there were a number of basophilic granular masses within the granulation tissue. Upon closer study, these were seen to consist of masses of intertwined, thread-like organisms of various lengths. At the periphery of one such colony, definite clubs were observed. (Figs. 1 and 2.)

Diagnosis.—The diagnosis of actinomycosis of the periapical granuloma was unmistakable.

Treatment.—It was suggested that iodide therapy be instituted at once. However, the medical staff decided that potassium iodide was contraindicated in the face of the pulmonary tuberculosis, since the drug would tend to destroy the granulation tissue walling in and localizing the tuberculous process. It was therefore decided to thoroughly curet and cauterize the socket and not employ chemotherapy. An iodoform gauze dressing was inserted and the socket was irrigated and redressed every other day until healing was sufficient, several weeks later, to permit natural closure without further interference.

Outcome.—Follow-up roentgenographic studies four months later, May 27 (Fig. 5), showed filling in of bone, with apparently normal trabeculation in the area. The picture ten months after operation (Fig. 6) showed practical completion of the healing process.

Comment.—It is interesting and important to note that this lesion was the only manifestation of actinomycosis discovered in this patient. January 27, residual roots of the maxillary right first molar were extracted, and the granulation tissue from this area was reported as non-specific. Similarly, when the maxillary left second molar was removed subsequently, the periapical granuloma showed only the usual type of granulation tissue. Clinically and roentgenographically, the original lesion had appeared to be what might have been considered a routine case of chronic periapical infection. However, it is good practice, not only in institutional dentistry, but in the office as well, to send specimens to the laboratory for confirmation of the diagnosis, particularly when there is any deviation from the usual. This is one case wherein such a procedure probably prevented a great deal of future trouble for the patient.

Fig. 5.—Filling in of bone and apparently normal trabeculation (May 27).

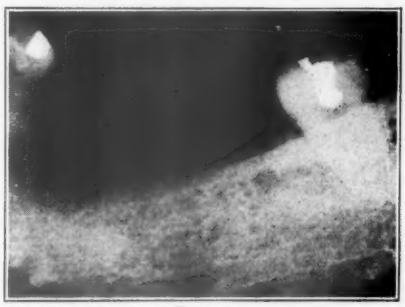

Fig. 6.—Completion of healing process, ten months after operation.

CONCLUSION

In view of the findings in this case, it seems advisable to recommend (a) careful and complete removal of granulomata from tooth sockets after extraction and (b) routine microscopic examination of the tissue by a qualified pathologist. In the case described, it is possible that the infection entered through the carious crown of the bicuspid, if not by means of the subgingival route, and was arrested by the protective granulomatous response. Fortunately, the lesion was discovered early and excised completely before the tissues could break down and permit extension of the infection to adjacent parts or perhaps even

by metastasis to the vital organs. Certainly, this case confirms the rôle of the teeth and oral cavity as a portal of entry for the ray fungus. It emphasizes the necessity of eliminating dental carious lesions and of treating all teeth with signs of periapical infection. Dental infection by the ray fungus or by any specific organism such as the tubercle bacillus is not usual. But such an infection may serve as a focus from which the organisms can be poured into the system at a time of lowered resistance, with disastrous results to the host.

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FURTHER STUDIES IN EVALUATING ACRYLICS FOR MASTICATORY SURFACE RESTORATIONS

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RESULTS in reconstructive dentistry are to a great measure dependent on the restorative materials employed, which, in turn, have been noted to experience an interesting and more or less definite cycle.

First, these materials are born—introduced into dentistry by some clinician or manufacturer. Next, they live for an indeterminate period, depending somewhat on the material itself and somewhat on the prestige of the early enthusiasts for it. Finally, they die out—a great number of them while still in their infancy.

Fortunately for dentistry, not many materials have succeeded in living very long when their acceptance was unwarranted. And, in late years, owing to a greater awareness on the part of the dentist and because of the studies of the Research Commission of the American Dental Association at the National Bureau of Standards, this infancy period of trial and error has been shortened.

Methyl methacrylate, hereafter referred to as acrylic, is now well into its second phase of the trial and error cycle. It is the purpose of this article, therefore, to discuss further some of the physical properties of this material and especially to present some data on these characteristics not immediately accessible to average experience, but of sufficient importance to be taken into consideration in determining the adequacy of acrylic for masticatory surface restorations.

FLOW

Acrylic is an elastic material. It is, therefore, necessary to find out whether, with the constant compressive loads applied during mastication and grinding of foods, some of which are relatively hard, there is any deformation or flow. In other words, if one is intending to use the material where constancy is a requisite, he certainly should make sure that the elastic recovery after compression of deformation is complete.

When an elastic material such as rubber

or acrylic is compressed, energy is given to it; that is, it takes a certain amount of energy to cause a compression or deformation of the material. When the material is decompressed or re-forms, the material gives up energy. To completely re-form, or return to *status quo,* exactly as much energy must be given off in decompression as was taken up during compression.

Energy, when absorbed during this compression (loading), will not be available to completely re-form the material during decompression (unloading), and there will have occurred what is known as a mechanical hysteresis. This indicates an imperfect resilience or deformation.

Does or does not this occur in acrylic subjected to masticatory stress?

Gabel and Smith,[1] attempting to find relevant and much needed data on this point, have carried out a series of experiments at the University of Pennsylvania School of Dentistry. A careful study of their paper is recommended.

Using appropriate types of testing equipment, they obtained interesting results on specimens of properly processed dental acrylic. It is intentionally here mentioned that these scientists were careful to obtain properly processed specimens, for they had found that "in the beginning, when specimens were prepared by numerous individuals, the variations in behavior were extreme," and "some of the poorer and improperly processed material flowed rapidly and at an almost constant rate until the deformation was easily discernible to the unaided eye."

Attention is called to their Figures 3 and 4, here reproduced as Figure 3, wherein they show plainly the hysteresis in methyl methacrylate. They conclude:

> An analysis of our experimental work to date seems to indicate that properly processed methyl methacrylate tends to behave like an elastic material but undergoes a certain amount of permanent distortion under a constant load maintained for an appreciable time. The rate of change of distortion is retarded, apparently by internal friction, so that it has a logarithmic decrement in both compression and recovery. Furthermore, it exhibits an hysteresis-like effect, recovery not being complete.

Further illustrating the bad effects of such weakness in a dental material is the excellent work done by the American Dental Association's Research Fellowship at the National Bureau of Standards.

In this study, using an acrylic denture with acrylic teeth, J. R. Beall[2] found that certain cusps, such as the distobuccal and mesiobuccal cusps of the upper right first and second molar teeth, elongated while in use; whereas the mesiolingual and distolingual cusps of the same teeth showed considerable wear. The elongation, particularly, seems, in my opinion, to be an example of flow.

This and other data assembled warranted Beall's statement that until such time as reliable data are available, as a basis for judgment, it is suggested that the practitioner continue to warn his patients that acrylic resin teeth are "experimental rather than permanent.

ABRASION RESISTANCE

The function of teeth is to grind and triturate food and prepare it for further digestive processes by properly comminuting it. The masticatory surfaces of the teeth are the surfaces which engage the food and against which the food is crushed and ground.

In chewing hard candies, chicken bones, some of the uncooked whole wheat cereals and even toast, rye crisp, nuts and the like, there is a chance for an unusual amount of abrasion. Therefore, whether the masticatory surface has a hard or soft surface and how that surface will resist abrasion is of considerable importance.

There are several recognized methods of determining the abrasion resistance of any given material. These are predicated on learning the effect of rubbing or mull-

ing, as will occur during mastication, or the effect of falling particles, as might be required of a material subjected to windblown particles.

With teeth, we are, of course, interested in the former test only, and, by means of the Tabor abrador, the number of revolutions required to abrade the specimen of acrylic—using three-eighths inch felt pad wheels filled with No. 302 emery, under a load of 76 gm.—is compared to the revolutions needed for equivalent abrasion on other well-known substances.

These tests show acrylic to be only one five-hundredth as resistant to abrasion as glass.[3] Its surfaces are so vulnerable to abrasion that the manufacturers of the material have this to say under the subheading of "Applications" in the chapter on "Abrasion Resistance."[4]

Its scratch resistance, however, is low enough so that Plexiglas is not recommended for use where it will be subjected to any great amount of scratching as on table tops, floors, stairtreads, etc. The use of common scouring compounds on Plexiglas is specifically discouraged since they usually contain coarse abrasives.

If a table top that is not to be subjected to any grinding stresses should not be made of acrylic, and if even common scouring powders are injurious to acrylic surfaces, how suitable can such a material be as part of a grinding and crushing mechanism?

The dentist or his assistant can carry out an interesting experiment at this point by taking two flat pieces of acrylic and placing between them a small

MISCELLANEOUS PROPERTIES (*Contd.*)

The general effects of certain chemicals and solvents on cast "Lucite" under normal conditions have been observed. The results are presented here for preliminary guidance only.

CHEMICAL	EFFECT ON "LUCITE"
acetic acid	not attacked by concentrations of less than 50%
acetic anhydride	attacked
acetone	readily attacked
acetylene	inert
alcohol	slowly attacked
acetaldehyde	not attacked by dilute concentrations
aluminum sulfate	not attacked
ammonia	see ammonium hydroxide
ammonium bifluoride	inert
ammonium chloride	inert
ammonium hydroxide	inert toward all concentrations but may yellow
ammonium nitrate	inert
ammonium sulfate	inert
ammonium sulfite	inert
amyl acetate	attacked
aniline	attacked
aqua regia	attacked
battery acid	inert

Fig. 1.—Reproduction of page 113 of Manual on Lucite, methyl methacrylate resin manufactured by DuPont.

CHEMICAL PROPERTIES

(A.S.T.M. Tentative Method D543-41T)

Pieces of Plexiglas 1" x 3" x .125" were totally immersed in the following chemical solutions for 192 hrs. at 25°C. and the absorption measured.

*Immersion Solution**	*Percent Weight Gain* Plexiglas	Crystalite
30% Sulfuric Acid	0.1	0.6
3% Sulfuric Acid	0.5	1.0
10% Hydrochloric Acid	0.5	0.7
10% Sodium Hydroxide	0.4	0.8
1% Sodium Hydroxide	0.5	1.0
10% Nitric Acid	0.9	0.9
5% Acetic Acid	0.8	1.0
100% Oleic Acid	0.0	0.0
2% Sodium Carbonate	0.8	1.0
10% Sodium Chloride	0.8	0.9
10% Ammonium Hydroxide	0.7	0.9
3% Hydrogen Peroxide	0.8	1.0
100% Distilled Water	0.9	0.9
Gasoline	0.2	0.2
95% Ethyl Alcohol	24 (Softened and made flexible)	Dissolved
50% Ethyl Alcohol	6 (Softened and made flexible)	Dissolved
Acetone	Dissolved	Dissolved
Ethyl Acetate	Dissolved	Dissolved
Ethylene Dichloride	Dissolved	Dissolved
Carbon Tetrachloride	Dissolved	Dissolved
Toluene	Dissolved	Dissolved

**All concentrations given in % by weight in distilled water.*

A gain in weight of 1% or less is considered negligible except in unusual applications.

Fig. 2.—Reproduction of page 91 of Technical Data on Plexiglas, methyl methacrylate manufactured by Rohm & Haas Co.

amount of hard candy, such as a peanut bar. The experimental device is kept moist in order to reproduce more accurately mouth conditions and crush the piece of candy between the slides of acrylic.

After two or three minutes of this procedure, the acrylic surfaces are observed in order to note the size and extent of the abrasions. If the surfaces had interlocked, as the cusps on teeth do, even greater abrasion would be seen.

CONTACT POINT

The history of the progress of operative restorative dentistry can be conveniently divided into the periods before and after the discovery of the significance of the contact point.

The first was an era marked more particularly by the extraction forceps. The second and more recent period of tooth conservation followed the discovery of the stellar rôle that the contact point plays in the life and good health of the tooth and surrounding tissues.

With that knowledge, it has been axiomatic that one of the most important considerations in a dental restoration is to reproduce skilfully and faithfully a hard "marble-ball contact point."

It is recognized that a restoration having a bad contact point is far more destructive to the economy than an ill-fitting filling with, let us say, bad margins, but a good contact point. The ill-fitting filling may lead to the ultimate destruction by caries of the tooth in which it is placed, but an improper contact point will not only tend to cause the loss of that tooth by pocket formation, but also may be the cause of a generalized pericementitis that will be embarrassing to proximating and more distant teeth.

The reason for bridgework or replacements of teeth is often primarily to maintain the contact points. A patient may masticate well with a tooth missing, but he is cautioned against the hazards of

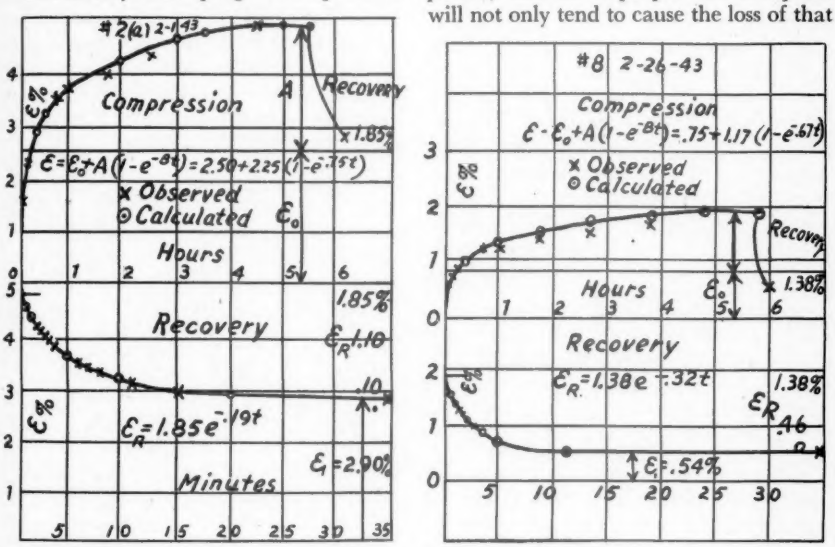

Fig. 3.—Compression and recovery curves with comparatively high compressibility and permanent distortion. The curve at the upper right is the same as the recovery curve below, but drawn to the same time scale as the compression curve. The graph on the right is the same as that on the left except that the material has comparatively low compressibility and suffers permanent distortion.

shifting teeth. The wise dentist tells his patient that this may cause a loss of contact, which may eventually harm the remaining teeth and even cause their loss.

When a contact point is (a) soft, (b) flat, (c) open, (d) improperly placed or (e) rough and poorly polished, it is a failure.

Teeth do not remain perfectly still or fixed during mastication. The periodontal membrane in which they are set yields somewhat to allow each tooth an independent movement.

During this activity, there is apparent a slight movement at the contact point, sufficient to cause a "riding" of one point upon the other. To maintain itself under these stresses, the contact point must be made of a hard material which will not easily flow, flatten, wear or become abraded, but will retain the "marble-ball contact point" as Nature designed it, to be placed at this friction point.

McGehee[5] points out the well-known fact that an improper contact can also be the cause of decay:

> Secondary extensions gingivally of proximal surface decays are frequently due to flat or open contacts which allow impaction of food masses, roughening of the surface and decalcification from the resultant action of the acids of fermentation.

Therefore, to be considered safe for restorations contacting other fillings or other teeth, a filling material must be expected to have (1) sufficient hardness, (2) a fair resistance to abrasion, (3) resistance to flow and deformation when in small masses and (4) freedom from a tendency to shrink.

The Plastics Catalog of 1944[6] gives the Brinell hardness of the methyl methacrylates as 18 to 20. Sasso[7] gives them the same hardness number. Rohm and Haas,[3] who manufacture methyl methacrylate, gives this value for hardness in its technical data book; namely, 18 to 20.

As compared with this 18 to 20 Brinell hardness, the American Dental Association's specification No. 5[8] calls for an absolute minimum Brinell for what is to be labeled Type A—"soft inlay gold, subject to very slight stress"—of 40 to 75. It can be seen that even if the hardness of acrylic was increased by 50 per cent, it would still not meet the minimum figure.

S. A. Leader,[9] in THE JOURNAL for November 1943, states that a comparison with metals for hardness is not fair, giving the following reasons:

> He (Saffir) then proceeds to compare it adversely with pure gold, which is much harder, but still too soft for most restorations. He[10] omits all reference to ductility and resilience. A heavy duty rubber motor tire with a Brinell figure below 5 would stand up to thousands of miles of road work far better than a pure gold tire. Not only would the gold wear more rapidly, but it also would quickly flatten, lengthen and leave the vehicle. If Dr. Saffir is in doubt, let him file and hammer tire rubber and pure gold simultaneously and see which is the more resistant to attrition.

It is because I am aware of the "ductility and resiliency of acrylic" that I condemn it for masticatory-surface use.

It is conceded that a gold tire will not perform so well on an automobile rim as one made of resilient rubber, but it is just as true that the very resilience of rubber or acrylic is what prohibits its use in a masticatory replacement. Can Dr. Leader favor a resilient contact point?

The commercial considerations given to the fabrication of acrylics are worth noting. In Simonds and Ellis, 1943,[11] under the heading "Characteristics Determining Fields of Use," in a guide to selection for use based on characteristics of materials, the following appears under methyl methacrylate (cast or molded): "Light weight, excellent resistance to weathering, available water-clear transparent to wide range of colors, dimensional stability, edge-lighting ability, soft surface, easily fabricated."

There is yet to come to my attention the textbook on physical properties of dental materials which does not make the statement that, for occlusal surface restorations, "hardness" is of the first consideration. By hardness, "the ability of substances to indent one another" is meant.

It should also be noted that some of the foods and liquids entering the mouth may adversely affect the acrylics. Examples are here given in Figures 1 and 2, which are copies of information from the manuals of the manufacturers of this material.

Possibly none of our patients will expose their acrylic restorations sufficiently to alcohol to cause them to become "softened and flexible and gain 24 per cent by weight, as described by the manufacturers, but certainly the intake of alcohol is to be considered when one has an acrylic restoration whose effectiveness is due to its precision fit.

SUMMARY

Acrylic, which is elastic, does not have perfect elasticity and undergoes deformation under stresses that ought not to deform a dental filling material. It flattens easily. Acrylic is vulnerable to the type of abrasion incident to mastication. It is not hard enough to act as a grinding means during mastication. Acrylic does not have the physical properties to withstand and resist the movements of mastication and resist impaction of food at the contact point. It is also injured by some of the substances taken into the mouth.

It would seem to be against all conservatism and against the teaching of scientists like G. V. Black, for instance, to employ a material with the above qualities for the restoration of contact points or masticatory surfaces or for the making of artificial teeth.

He who sees only the esthetic possibilities of the material and is attracted by the ease with which the material is manipulated might do well to heed the advice of Anatole France: "My child, beware of pastry. Pastry is factitious, adventitious. It is whipped cream which fails to hide the poverty of the cake."

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THE PROBLEM OF DENTAL HEALTH CARE FOR THE AMERICAN PEOPLE

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DENTAL care for the American people in the postwar period will be provided by a national health plan fashioned from one of two current movements that had their beginnings and partial development in the last decade of the prewar period. Either it will have as its base the existing health agencies, and will issue from the determination of the health service professions to make such adjustments in their present organizations and relationships as are necessary to provide health care for the whole population, or it will take the form of an artificial device designed to place the full responsibility for health care upon the federal government under a bureaucratic system. These trends are characteristic of two contending political concepts that have intrigued political philosophers of all time.

On the one hand is the concept that the greatest good accrues to society as a whole from a system of free enterprise; on the other, the theory that the interests of society are more secure under a central authority which prescribes the social pattern. In the first instance, the function of government is to enact benevolent laws that will preserve and foster freedom of enterprise and provide certain limited regulations in the public interest; in the second instance, government displaces private initiative and private enterprise and directs by regulations all public service functions. It is from one of these two theories that we may expect to derive the postwar plan of dental and medical care.

The fact that all interested parties are now considering what plans are best suited for the broader distribution of dental health care may be accepted as proof of the final belief that a serious oral health problem exists. This belief is supported by the incontestable evidence produced by numerous and extensive surveys that have been conducted to determine the status of the oral health conditions of the American people. The clinical experience of the dental profession in treating oral disease, and the results of experiments conducted by it, clearly prove the widespread need for dental health care. Therefore, the American Dental Association has conceded the existence of a problem and has officially expressed its opinion that some universal plan of health care should be devised to serve adequately the public need.

In seeking a solution to this oral health problem, dental leadership has considered seriously the possibilities of the two plans above described and has attempted to evaluate their advantages and disadvantages as each promises to contribute to the fullest needs of society. The American Dental Association has come to the conclusion that the American ideal can be served best by following the direction which experience has indicated. This direction is represented by a combination of the advantages found in health promotion activities that are a part of the curriculums of elementary

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and secondary schools; in the preventive functions of public health agencies on local, state and federal levels, and in the effective treatment and rehabilitation that are provided by private practice. These social agencies, while currently not adequate to meet the fullest needs of society, are so constituted that they may be expanded in volume and modified in form to support a competent and adequate national health program. But, what is equally important, they are democratic institutions and represent tendencies of a democratic society to fashion those instruments by which its fullest requirements may be met. It has been demonstrated that the foregoing agencies combine the safeguards necessary to ensure quality service in a national dental health plan.

May I emphasize briefly at this point the important part that the American physician and the American dentist have played, as scientists and citizens, in contributing vitally toward the advancement of our country to its present high position among the nations of the world?

The superior quality of medical and dental resources in the United States and the superior quality of medical and dental care of the people are frankly admitted by those familiar with them. In the United States, during the past century, the sciences of medicine and dentistry have advanced in effectiveness to a position of preeminence among the contributions of the nations of the earth. The art of medical and the art of dental practice have been perfected to a degree of excellence unequalled among the peoples of other countries. The quality of medical and of dental care available to the citizens of the United States is today superior to that received by the citizens of any other country on the globe. No thought, no effort, no sacrifice have been spared by the health professions to keep the efficiency and proficiency of health care in the vanguard of modern progress and to adjust it effectively to the uses of the American way of life.

The members of the health professions deserve great credit for the contributions that they have made to the advancement of American culture. Their achievements have not been casual or accidental: they have been accomplished through the deliberate design and purposeful effort of men dominated by the same inherent urge that has impelled American manhood in all departments of endeavor and on all levels of service to make of this country the greatest nation in history. The saga of America's greatness is not alone the story of the achievements of statesmen, of captains of industry, of business men. It includes the vital and essential contributions of all—the minister, the lawyer, the physician, the dentist, the teacher and those of shop and craft. If America is truly great, material progress alone has not fashioned its greatness: the cultural contributions of all its people have made our national power possible, and have promoted effectively that national refinement of living which we proudly refer to as the American way of life.

The American Dental Association is committed to a continuing support of our free American institutions. Because of its activities in establishing sound public relationships, its motives have been questioned frequently by some who have sought to injure its prestige by leveling against it the general accusation of selfish purpose. Organization is an age-old device and, when used for mutual benefit and for the common good, is a valid and ethical procedure. The country to which we owe allegiance became free, prospered and advanced to the position of the leading world power by adhering to the simple principle that in union there is strength. Through the fraternal cooperation of its multiple institutions, this country became knit into a solid, powerful nation. Its great achievements during the past four years

have been made possible only through the smooth functioning of all parts of a great organization, each and every one of which is essential to the successful war effort. In like manner, organized dentistry has, through the cooperation of its members, contributed effectively to the health of our people. In view of its benevolent character, and of the contributions that it has made to the usefulness of oral health service, it appears that the American Dental Association may be trusted to represent the health interests of the American people in formulating a national health program to serve the oral health needs of the people, and, at the same time, conserve the high professional standards essential to health care.

Organized dentistry has always stood for the extension of dental service to the whole population. It has publicized repeatedly and extensively the great need for dental care that exists among the people. It has promulgated programs of dental health education. It has given of its time and facilities to bring to the people as much health information and health service as possible. It has studied the health needs of the people and has given to its members information that has crystallized their concepts of public health needs. For many years, dental leadership has been keenly aware of the need for the expansion of dental care to include more of the population. The recent revelations made by the Selective Service System of the high rate of rejections of American youth because of faulty oral conditions astounded every one—but the members of the dental profession. They knew these untoward conditions existed. They had for more than twenty-five years warned the public of its peril and they had pleaded with those in positions of authority to assist in establishing better conditions. Dental leadership has not awaited a great emergency to be reminded of its social responsibilities. It began years ago its attempt to excite public concern for the faulty oral health conditions of the people. It has made creditable progress in spite of the fact that it was obliged to move forward with little public encouragement and only meager public support.

The American Dental Association has consistently sought an answer to this perplexing question. Since 1934, it has made periodic announcements of the principles upon which an acceptable national health program should be established. During recent years, it has outlined a program which, if made effective, would distribute dental care to larger groups of the population, perpetuate private enterprise and maintain the principles upon which dental health care has been effectively and competently developed in this country. It has clearly defined its attitude and announced its policies with respect to a public health program. It holds that the basic provisions of an acceptable national health plan must ensure dental health service of quality and must preserve the principles upon which dental science and dental art in America have been developed. The policies enunciated by it have been utilized by its official representatives in stating the attitude of the American Dental Association toward various federal health plans that have been projected.

Those acquainted with the efforts put forth by the American Dental Association to prepare itself for this emergency must be convinced of the validity of the conclusions reached by its representatives charged with the responsibility of studying oral health conditions and of proposing a national health program. After the hearing on the proposed National Health Act of 1939, the National Health Program Committee of the American Dental Association worked out in detail a tentative plan for Dentistry's participation in a national health program. Briefly, the plan recommends the

utilization of existing social agencies for purposes of health promotion; namely, the various elementary and secondary schools, local and state health departments and the facilities afforded by private practice. The method of utilizing these agencies was carefully outlined by the committee, whose reports[1] form a reliable guide for establishing suitable and effective local, state and federal health relationships.

The facilities of local health departments and of the school systems have been the instruments by which creditable progress has been made in advancing dental health care throughout the country. It is significant that, twenty-five years ago, absolutely no formal attention was paid to public dental health. Today, forty-two states have dental divisions ranging in effectiveness from wide distribution to fairly good coverage. These programs have been made possible through the generous encouragement and cooperation of private practitioners and a limited public support. It is concluded from these experiences that the expansion of the facilities and of the functions of local and state health departments, the broadening and strengthening of health education and service programs for school children, the encouragement of voluntary prepayment plans in those communities where they may be desirable and practicable and the financing of health care for the dentally indigent would, if encouraged on a nation-wide basis, constitute the elements of an effective national dental health plan.

The school systems of the country have not advanced their health education and physical fitness programs to the point necessary for satisfactory coverage. Some individual schools and some groups of schools have done an excellent job. Others have been indifferent and lax in their attention to health education as a school function. There is, under the growing pressure of educational sociology, a strong tendency to make health education one of the most important divisions of elementary and secondary school curriculums. It is highly desirable to develop in the school systems—the elementary and secondary public, parochial and private schools—effective dental health education programs for all children. To teach the youth of this land to live healthy lives is as important as to prepare them for useful occupations and for good citizenship, and to teach them the values of preventive dentistry and the habits of self-care is even more important than to devise health programs for the purpose of providing cure only.

The state and local health departments operate largely on the principle of prevention as it applies to groups. Their function has been to control those conditions that might lead to the spread of disease throughout the community. Health departments were organized originally in response to local need for health protection through the application of preventive measures. From their initial form, they have been expanded to assume limited functions in the administration of certain general health practices that have grown in scope and number throughout the years. If one will but contrast the expanded functions of a present-day health department to the same agency's activity in its early years, convincing proof may be found that, given the necessary financial support for the purpose of expanding physical and personnel facilities, local and state health departments can meet any local demand for health protection and health care that cannot be provided by private practice. Almost all dental divisions or bureaus of state health departments that originally devoted themselves merely to service to school children have since expanded their programs to include services to expectant mothers, preschool children and the indigent of all ages. The trend is toward an expansion of service to provide for what we may term

the neglected groups of the population. One may recognize in this progress the natural tendency of the body politic to provide for its own complete needs. The trend should be encouraged and accentuated that it may the sooner reach satisfactory quantitative proportions.

On the other hand, it is not believed that the high quality of dental care to which the American people are accustomed or the solid foundations upon which dental science and art in America have been superimposed can be preserved under a national program of regimentation. The leaders of American dentistry do not fear any program of universal health care that may be established within the scope of democratic procedures. They do fear the effect of regimentation on the quality and usefulness of the health services, and they have challenged vigorously certain proposals to abolish America's traditional plan of health care in favor of doubtful health programs that are indigenous to social conditions in foreign lands quite unlike those under which American institutions have thrived.

For the past ten years, certain government agencies have considered plans for inaugurating a national health program to be financed by federal funds and administered by a federal bureau. They have conducted studies to determine the effectiveness of the proposed procedures and have sponsored certain conferences to determine professional and public opinion on centralized plans of administration. These efforts have indicated a determination to inaugurate a federal plan by way of federal legislation. Those who are supporting a plan for compulsory health care support their preference for such a program on the grounds of its financial soundness, from the standpoints of both the government and the patient; and they attempt to establish the validity of the plan on the grounds of its alleged successful operation in certain foreign countries. These proponents have shown that service of quality *might* be accomplished, but at no time have they demonstrated convincingly that under such a plan the welfare of the public would be protected or that the foundations of the profession would be so maintained as to perpetuate their effectiveness unimpaired.

In recent years, a number of legislative efforts have been made to inaugurate a federally supported national health program. Among these attempts are the Social Security Act of 1935, the proposed National Health Act of 1939 and the Social Security Bill of 1943. The American Dental Association has in all these instances assumed an attitude consistent with its official policy. Through its spokesman, the National Health Program Committee, it opposed certain basic features of the 1939 National Health Act, but approved the principles of greater health care distribution underlying the measure: "The attitude of the American Dental Association toward all efforts to formulate an efficient, feasible and comprehensive national program for dental health has been one of leadership and cooperation. The association has consistently favored, upheld and fostered the objectives that motivate the National Health Program and S.1620."[2]

The current Social Security Bill, known popularly as the Wagner-Murray-Dingell Bill, received the careful attention of the Council on Dental Health of the American Dental Association. The Council studied the provisions of the bill and estimated its possibilities as measured by the set of principles announced by the American Dental Association. Since the subject of dental health care was ignored by those who drew up the bill, and therefore any specific consideration of dental health with respect to social security was postponed until a future date, it might appear that Dentistry should not be concerned with this particular proposal. However, realizing that an oversight could not possibly invali-

date Dentistry's moral right to express an opinion on legislation that indirectly now and directly later must be of concern to it, the House of Delegates, upon recommendation of the Council on Dental Health, reiterated its willingness to approve any suitable measure designed to ensure a greater volume of dental care, but opposed the particular plan outlined in the Wagner-Murray-Dingell Bill on the grounds that it violates the established principles approved by the Association as requirements for an acceptable national health program.

There are a number of important reasons that dentistry has not been in agreement with federal proposals for a national health program. One has been the failure of those promoting legislation, or of their technical advisors, to seek or to heed the advice of dental leaders in matters that affect the vital professional aspects of the problem. As a consequence of this policy, the details of proposed federal health legislation were decided finally by those who had only an academic knowledge of the special problems involved, and who included in their proposals certain objectionable features that the profession could not accept. It is impossible for one lacking intimate knowledge of the fundamentals of any subject to speak authoritatively on it. Under such circumstances, an expert becomes an empiric. The situation reminds one of a statement by Lord Halifax that the farther one is removed from India, the simpler India's problem becomes. One of the "eight points" included in the American Dental Association's recommendations for an acceptable national dental health program is: "In all conferences that may lead to the formation of a plan relative to a national health program, there must be participation by authorized representatives of the American Dental Association."[3] This stipulation does not mean that the American Dental Association wishes to dictate the terms of a national health program, but it does mean that the Association desires to participate in perfecting useful legislation, which, it believes, can be accomplished only through the utilization of the intimate experiences and the understanding of leaders in this special field.

A second point of disagreement stated in the opinion held by the American Dental Association is that all plans for federal control of health care so far proposed cannot, in their final analysis, operate in the ultimate best interest of the public. The American Dental Association places the public welfare at the head of its list of considerations for an acceptable national health program, and insists that the quality of the service to be provided be considered as of first importance in any legislation designed to increase the quantity of oral health care. It recognizes that dentistry exists as a profession only because of the effective contribution that it is capable of making to the health and welfare of the people. It points out that standards of quality in dental education and practice are encouraged by public laws that, in the interest of the people, reserve to a specially qualified few the right to serve the oral health needs of the masses, and that values of quality have been protected by these safeguards. All federal proposals for the administration of health care have been based on organizational formulas that include certain coercive provisions with the latent capacity for breaking down the safeguards of quality in health service. Dental leadership holds that the existing prescription of qualifications for dental practice shall persist inviolate and without jeopardy in the interest of the public welfare.

The American Dental Association holds that maintenance of the integrity of the professional worker is a corollary of the safeguards provided the public welfare. There can be no satisfactory health service, regardless of the mechanism adopted to provide it, without the

availability of a competent group of professional men to render the services required. American dentistry has reached its exalted position of usefulness because of the freedom its adherents have enjoyed in determining their course of action and because of the opportunities provided them for full self-expression. The administration of proposed federal health plans calls for the employment of the panel system. Men of quality in a free country will not choose a profession the pursuit of which requires that their names be listed on a panel that places restrictions on their capacities for achievement, a profession in which the economic rewards are determined by statisticians. True manhood strives for freedom of expression and rebels against and will resist to its utmost the slavery imposed by rigid forms and arbitrary regulations. Undue restraints must not be imposed upon the dentist in the administration of any health plan; nor should any regulations be tolerated that would dull his incentive, inhibit his urge for self-expression or limit his opportunities for individual enterprise. Anything that threatens the integrity of the dental profession or tends to limit the freedom of self-determination, self-discipline and self-direction of the dentist can operate only to the detriment of the public and will be vigorously resisted by the members of the dental profession.

It is conceded that the less complex the organization, the more easily it can be adjusted to the changing or emergency needs of its members and the more efficient it becomes in achieving its objectives. The American Dental Association insists that a fundamental of any health program is its ready adaptation to local conditions. It is agreed by experienced health workers that the most effective health program is that which is organized on the local level, with final authority vested as far as possible in local administration, in order to ensure flexibility in operation. Remote administration operates with a rigidity demanding absolute conformity, which prevents ready and effective achievement. The complexity of a federally controlled health plan would reduce efficiency, inhibit usefulness and create a situation wholly unacceptable to the American people. It is the opinion of the American Dental Association that the needs of the people and the obligation to the taxpayer cannot be competently met, and that the quality of dental service rendered and the effectiveness of the professional worker cannot be achieved by substituting a regimented national health program as an alternative to a further and more adequate development of existing local and state health agencies.

Freedom of thought and freedom of expression are the vehicles of invention, discovery and progress—the activators that have made the American way effective and satisfactory. It is impossible to devise a national public health mold and cast into it the communities of this land, with any hope that their citizens will receive a competent social service; nor is it possible to forge shackles of regimentation so salutary that they will allow human resourcefulness full play to perpetuate America's greatness. The latitudes of human opportunity and of individual enterprise that have combined to make us a great nation must be preserved.

The American Dental Association is sincerely concerned about the dental health conditions of the people of the United States. It has at no time obstructed reasonable efforts to improve the existing situation. It desires to see adequate dental health care made available to the whole population. But, having borne the responsibility of advancing the quality of dental science and art to its high degree of usefulness, it feels a continuing responsibility for insuring dental health care of quality for all who require it.

Dental leadership is convinced that a

heavy responsibility rests also on the official representatives of the public to provide the financial assistance necessary to expand the capacity and functions of existing social agencies so as to provide adequate health service for the whole people. It insists that members of the dental profession shall take a prominent part in the deliberations that may lead to a national health program, and that the details of the professional phases of such a program shall rest upon the authority and judgment of dentistry's representatives. Dental leadership is qualified educationally and temperamentally to engage in planning a device to meet the complete oral health demands of society.

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FACTORS IN THE DEVELOPMENT AND PROGRESS OF THE ARMY DENTAL CORPS

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THE Army Dental Corps was officially 43 years of age February 2, 1944. Those dental officers and civilian dentists who are familiar with the early history of the formation of the Army Dental Corps, and the years that followed, realize the tremendous progress that has been made to date.

Records reveal that the civilian dental profession has always had a keen interest in all military affairs as well as legislation, and that they have been generous in giving their time and assistance in every important issue. One of the first references in dental literature to the needs of the Army appeared in an editorial in the *American Journal of Dental Science* in 1859,[1] reading in part:

> At the last meeting of the American Dental Convention, a committee was appointed to memorialize Congress on the necessity of appointing dentists for the service of the Army and Navy.

It is interesting to note that dentists were first utilized in the Confederate States during the Civil War. W. Leigh Burton,[2] in an article written in 1867, relates that it was impossible for soldiers in the Confederate Armies to pay for dental operations, since the cost of one gold filling in the depreciated currency of the Confederacy was more than six months' pay of a private. This condition led to the passing of rigid conscription laws through which dentists were conscripted into the Army service, in 1864.

The organization of the Dental Corps by the Act of February 2, 1901 provided for only thirty contract dental surgeons. It was not until the Act of March 3, 1911 that dentists were granted commissions in the Army of the United States, and such commissions were limited to first lieutenants.

*Major General (DC), U. S. Army.

Read at the Midwinter Meeting of the Chicago Dental Society, February 22, 1944.

The Act of June 3, 1916 provided for the rank of lieutenant, captain and major. However, the total number of majors was not to exceed fifteen.

The Army Dental Corps was finally given equal status with the Medical Corps in rank, pay, promotion and allowances, by the Act of October 6, 1917.

A large share of credit for the advancement and achievements of the Dental Corps must go to the civilian dental leaders who guided and promoted much of the legislation. A great debt is also owed to those early pioneers the contract dental surgeons, who proved and demonstrated to the Army the true values of dental service. These dental surgeons sacrificed position and financial reward to insure Dentistry's future in the armed forces.

WORLD WAR I

When the United States entered the World War in 1917, there were only eighty-six dental officers in the Regular Army, eighteen of whom were captains and the remainder first lieutenants. The largest number of dental officers on duty at any time during World War I was 4,620, November 30, 1918, and, of this total, the greatest number to be overseas at any time was 1,805, January 11, 1919.[3, 4]

The legislation that followed the first World War made possible the rank of brigadier general in the Army Dental Corps, assistant to the Surgeon General, in 1938, while the Act of April 3, 1939 provided for a total of 316 dental officers.

WORLD WAR II

Today, in World War II, approximately 98 per cent of the 14,000 dental officers come from civilian life, certainly constituting a cross-section of American Dentistry in thought and function. The professional ideals and initiative of these officers from civilian life is playing a very important rôle in the success and morale of the armed forces in every theater.

Dentistry and the Army Dental Corps to date are in a more favorable position than at any time in the history of the profession or military science. Recognition and authority have been granted the dental officer throughout the Medical Department as well as other channels; which has proved very advantageous in the administration and function of the Dental Corps.

One of the primary reasons for the success of the American and Allied forces has been the unification of command. The Medical Department is a part of the Army Service Forces. The Dental Corps, an integral part of the Medical Department, is called upon to approve and recommend the various needs of supply, personnel and policies as they affect the dental service. This teamwork, acknowledgment and cooperation of the dental and medical officers is without question a reality in the Surgeon General's Office, and this spirit of mutual aid has infiltrated down through the Service Command, camps and stations.

It is true that rulings or regulations made by the War Department to effect a more efficient prosecution of the war do affect the Medical Department and, in turn, Dentistry. Such a ruling was evidenced with regard to promotions as directed by the War Department, Army Service Forces, Circular No. 39, 11 June 1943, subject: "Method of Authorizing, Reporting, and Controlling Personnel," and a memorandum (Memo S605-17-43) July 21, 1943, entitled, "Promotion Policy for All Officers Under Army Service Forces Jurisdiction." These two directives set up the policies of promotion for the entire Army Service Forces in the Army of the United States. The laws in effect for the Regular Army Dental Corps as of 1917, 1920, 1938 and 1939 do not apply in their entirety to the dental officers commissioned in the Army of the United States. The Act of June 4, 1920, for instance, provides that dental officers be promoted to grades of captain, major, lieutenant colonel and colonel, after

three, twelve, twenty and twenty-six years' service, respectively; yet, during this emergency, increases in rank are in evidence wherein the dental officer has not served this minimum time for promotion as required during peace for the Regular Army. Furthermore, the Act of October 6, 1917 specified that there shall be one dental officer for every thousand of total strength of the Regular Army, while in this war, at the present time, the average of the total Army is about one dental officer to every 520 men.

During the first World War, there was slightly less than one dental officer per thousand men overseas, while, at this time, the percentage of dental officers is appreciably greater.

Promotions in the Dental Corps have been far more liberal during this war than at any time in military history. For example, two War Department Circulars, No. 122, May 18, 1943, and No. 228, September 23, 1943, permitted a change in the Tables of Organization of all tactical troops, and stated that any first lieutenant of the Medical, Dental or Chaplain Corps who meets the requirements for promotion, having served the required time in grade, may, upon recommendation, be promoted to the temporary grade of captain. The effect of these directives may be evidenced in an analysis of the distribution of rank in the Dental Corps in one of the larger theaters. The following is noted:

First lieutenants	18.1 per cent
Captains	69.1 per cent
Majors	11.3 per cent
Lieutenant colonels	1.1 per cent
Colonels	0.4 per cent

Promotions from first lieutenant to captain have been made possible within the Service Command installations, comparable to those of the tactical units, by the revision of Army Regulations. This change in the regulations will permit promotion to the grade of captain of all first lieutenants who are qualified and recommended. AR 605-12, Section II, paragraph 4d (3), February 3, 1944, reads as follows:

> Positions established by Tables of Organization or allotments for the Medical, Dental, Veterinary and Chaplain Corps in the grade of captain, first lieutenant and captain or first lieutenant may be considered in determining position vacancies as established in the grade of captain.

Unfortunately, the majority of the dental officers cannot realize a promotion to the field grades for obvious reasons associated with command and administration. Such promotions have, however, in general been made consistent with command responsibilities.

The Dental Corps and its value to the Medical Department and the entire Army's strategical program were signally recognized by the War Department in the directive "Preparation for Overseas Movement,"[5] which stated that:

> All necessary dental treatment, from a health and functional standpoint, will be provided troops prior to their departure from home station. The following policy will govern dental qualifications for overseas service: dental correction of all Class I cases as outlined in A.R. 40-510, including Change 1 and, as far as practicable, correction of Class II cases. . . .

About the same time, another important consideration was incorporated in the rewriting of A.R. 345-125, August 13, 1943, entitled "Military Records, Service Record," which requires that a brief description of dentures and other prosthetic appliances, together with date of issue, be placed on the man's service record.

A War Department circular was also issued in November 1943 further emphasizing the dental service and particularly prosthetic replacements. It stated that enlisted men will not be dispatched overseas who have any of the following defects: "Class I dental defects, except those individuals whose only defect is the need of prosthetic replacements, pro-

vided that, despite the missing teeth, they have been able to follow a gainful occupation in civil life and histories indicate that restoration of the missing teeth is not essential."[6]

These directives and the change in this Army Regulation have made a deep impression upon the minds of all military men. The tactical commanders in the past, in many instances, considered the dental status of his troops as secondary in importance, and, in some cases, there was no attention directed to dental treatment. The commander today is really serious about dentistry, the dental facilities and the men that he can regard as available for overseas combat duty. This officer must consider the ineffective rate to determine the efficiency of his unit.

The Dental Corps gained another point in attaining a specification serial number for the dental laboratory technicians. When war began, there was no difference in classification of a dental assistant and a dental laboratory technician. The result was that many medical cadres organized for overseas duty included well-trained dental technicians. An Adjutant General's Memorandum, issued[7] at the recommendation of the Dental Division, cleared up this important issue, and now dental laboratory technicians are not used as cadres for ground force units except where such technicians are actually needed.

PROFESSIONAL SERVICE

The dental officer in the combat zone of World War II is subjected to every handicap and every method of destruction known to the enemy. The units of the Medical Department accompany every invasion force. They land, not twenty-four to forty-eight hours later, but at the same time, set up first-aid stations and are ready for service when the first wounded and sick appear. There is no need for a time clock in an area of combat since fighting does not start or finish on a given schedule. The medical units are extremely busy during a battle and many hours thereafter caring for the wounded. Surgical operations are now performed within a short distance of the actual front line in tents and improvised shelter areas. Semimobile evacuation hospitals are found as near the front as is practical for major medical and surgical procedures in the care and treatment of all casualties.

Blood plasma, the sulfa drugs and more adequate supplies, with the presence of the physician, the dentist and the nurse in the forward combat areas, have paid tremendous dividends in a saving of lives not possible during the first World War.

Four maxillofacial teams consisting of one dental officer, one medical officer, two nurses and two technicians are assigned to each Auxiliary Surgical Group. They are available for service anywhere in the theater of operations, and are most frequently utilized at evacuation, convalescent, field and general hospitals to supplement the surgical service at those stations where the normal personnel cannot meet the demands of combat.

Another valuable addition to the field service has been the Mobile Dental Laboratory, which has been approved by the War Department. This laboratory will accompany troops to the combat area and will be available for denture construction and repair. It will greatly assist in retaining the men with dentures in the front lines, since a soldier with a broken or lost denture does not have to be evacuated now to a fixed installation in the rear area. It is estimated that from 18 to 20 per cent of the troops are wearing one or more dentures, which are necessary to masticate the Army ration. One can readily see the real task that the Dental Corps has keeping these troops dentally efficient.

Military needs, the movement of troops and training schedules have, in many

instances, necessitated plans and procedures, as related to dental treatment, not entirely in accord with the desires and wishes of the Dental Corps. For instance, a contingent of new troops arrive in a camp for training that may require four or six weeks. Some of these men have a considerable number of infected teeth that need removal. Surgical measures are instituted and the remaining teeth, if any, are filled at the earliest moment. Time frequently precludes the extended waiting period which is ordinarily desired before impressions for dentures are started. The result is that a certain percentage of dentures are made somewhat earlier than is considered desirable in civilian life. Some of these dentures will no doubt require additional attention in subsequent months in the overseas areas. This places a tremendous responsibility on the Dental Corps, yet the war must go on and it is Dentistry's job to make these troops available to the line officers in accordance with the over-all military plan. The civilian dentist should not be too critical or too hasty in evaluating the dental service unless he is thoroughly familiar with all of the problems, plans and schedules.

Since Pearl Harbor, the Army Dental Corps has completed the following dental service: more than 1,080,000 new dentures, 220,000 denture repairs and rebases, 31,142,000 fillings, 56,000 bridges and 3,235,000 prophylactic and pyorrhea treatments.

During the past several months, the Dental Corps has had approximately 94,000 appointments a day. There are many other phases of dental service which might be included in this brief over-all summary.

Since October 1942, the dental rejection rate for selectees has been about one per thousand, which is considerably lower than the number for World War I. The reduced dental requirements, the rapid induction schedules, the larger Army and the several theaters have created many problems not common to any of the past wars. The percentage of men requiring all kinds of dental service is appreciably greater, troop training periods vary more with the new and different mechanized units and the distribution of personnel as well as supplies to all sections of the globe is not comparable to that of the 1917-1918 period.

Since Pearl Harbor, the Army Dental Corps has made available for military service more than 800,000 men, or 53 divisions, that could not have qualified without one or more prosthetic appliances. There must be added to this three-quarter million men additional thousands that have been made available and maintained through the medium of denture repairs and restorations as well as oral surgical procedures. This sizeable group of men, which is nearing a million, rehabilitated by the facilities of the Army Dental Corps, plus those added hundreds of thousands that the civilian dentist has served prior to the time of induction is Dentistry's contribution to this war. This tremendous service to humanity cannot be measured in terms of dollars and cents, nor in terms of a battle won, but is to be recognized as one of the great contributing forces to health, happiness and freedom.

I have just returned from a six weeks' inspection trip through England, Sicily, Italy and North Africa. It was my privilege to see and hear the front line activity in Italy and to review the excellent work that the Dental and Medical Corps are doing in this theater. I was very favorably impressed with the accomplishments and the morale of the dental officers, as well as of the entire staff of the Medical Department. The equipment, supply and personnel problems have in general been satisfactory in these areas.

The responsibility delegated to those in the combat area is fully realized, and each is ready to make the supreme sacri-

fice that those at home may continue in the American way of life.

CONCLUSIONS

The Dental Corps is receiving favorable cooperation and recognition throughout the higher commands with reference to personnel, policy and supply. The status of the dental officer as related to promotion has materially improved and should be acceptable to the majority in the service. It is believed that more favorable consideration can accrue to the dental officers not in the Regular Army, but in the Army of the United States, from timely recommendation and direction to those in authority rather than through legislation. During periods of national emergency, the War Department is given broad powers whereby authority is delegated and questions of personnel and promotion are handled in accordance with an over-all plan in the expanded Army. It would not be militarily expedient during war to effect separate legislation for each component of the Army.

The benefits and recognition which have been gained by the Army Dental Corps since the beginning of World War I, as an integral part of the Medical Department and as an associate of the Medical Corps in the hospitals, would be depreciated and, in many instances, lost if complete autonomy were realized.

Dentistry, through its practitioners on the home front and its representatives in the Army Dental Corps, has demonstrated beyond any doubt its mission as a health agency and as an essential factor in military strategy during this war.

Although Dentistry has had many disappointments throughout the years, each reverse and obstacle has been a challenge to the pioneers and leaders in civil life as well as in the Army.

The future in this war, as well as the postwar program, will present many new military and social problems, calling for diplomacy, experience and leadership. American Dentistry, without reservation, is ready to assume its full responsibility as a health and humanitarian agency in the future events of the world, and the profession may well be proud of its achievements and contribution during this emergency.

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6. War Department Circular No. 293, par. 4 a (3), November 11, 1943.

7. Adjutant General's Memo, A.G. 201.6 (4-7-43) OC-A, April 14, 1943.

THE JOURNAL *of the*
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APRIL 1 *Editorial Department* 1944

IS THE DENTAL CORPS MEETING ITS OBLIGATIONS TO THE ARMED FORCES?

AT the recent Midwinter Meeting of the Chicago Dental Society and associated meetings, and particularly the midwinter meeting of the Board of Trustees of the American Dental Association, the keynote of each occasion was the efficiency of the service that the dental profession is rendering and is expected to render to the armed forces of the nation in the various theaters of war. So much interest was evinced in the activities of the Dental Corps that one entire session of the Chicago Dental Society meeting was devoted to presentation of reports from the Dental Corps of the armed forces and a discussion of the efficiency of the Army and Navy arms of the Corps. A report of intense interest was that by Major General Mills, head of the Army Dental Corps, which we are publishing in the present issue, on the efficiency of the service which the Army Dental Corps is rendering to the Army in the present war.

Much discussion has arisen in relation to the service of the Dental Corps in the Army and Navy and the character and amount thereof. In the early months of the war, it was the general impression on the part

of the dentists who were enlisting in the Corps that practically the only service expected of the Dental Corps was oral surgery. It seemed, for a while, that we were to have a corps comprised solely of oral surgeons, but the report of General Mills shows that dental service of all characters is being rendered, particularly prosthetic and operative dental service, and work of a character that we believe is meeting the dental needs of the armed forces in a practical manner.

In the early months of the war, a study of the number of draftees who were rejected as physically unfit for service revealed the appalling fact that approximately 18 per cent of the rejected enlistees were deficient in dental requirements. This distressing condition brought consternation both in the war recruiting service and in the dental profession, and steps were immediately taken to revise the dental requirements so that the number of enlistees rejected for dental defects would not be so disproportionate. The immediate expedient remedy seemed to be a material reduction in the dental requirements for enlistment in the fighting forces. These requirements for draftees were accordingly revised downward and to such a radical extent that practically no masticatory equipment was required for enrolment in the war service. In fact, if the draftee had no teeth at all, but his dental apparatus could be rehabilitated to chewing efficiency by dental service, he was acceptable and accepted.

To one who is familiar with the dental conditions in the mouth of the average person, it was apparent that a herculean task would be imposed on the Dental Corps in rehabilitating these men who were accepted so indiscriminately and with little masticating equipment. The work of the corps would not be all surgical: the larger portion would be prosthetic and operative work.

The report by General Mills indicates in a highly significant manner how efficiently the Corps has been able to meet the unusual demands made upon it. The dentist in civil life, to be sure, has done his share in rehabilitating many of these proposed enlistees and without stress upon the Army Corps.

General Mills states that, since the beginning of the war, more than one million men have been made dentally fit for army service, and most of this million men have become the responsibility of the Dental Corps; that is, the Corps is called upon to correct defects, cure dental disease and provide necessary dentures.

As an indication of the vast amount of dental work that this responsibility involves in the Army alone, more than a million new dentures have been furnished, more than 31 million teeth have been filled, 56,000 dental bridges have been inserted, 220,000 denture repairs have been made and more than 3 million prophylactic and pyorrhea treatments have been provided. During the latter months of 1943, 30 per cent more teeth were replaced by dentures and bridges than were extracted by the Dental Corps since the outbreak of the war, and General Mills reveals that Army dentists have had more than 16 million dental cases involving no less than 45 million sittings, and, for the past few months, daily appointments for dental treatment have averaged more than 94,000.

While the military symposium before the Chicago Dental Society was in progress, and while we were listening to General Mills and Rear Admiral Lyle recounting the humanitarian deeds of both the Army and Navy branches of the Dental Corps, announcement came from the War Department issuing an order to discontinue the Army Specialized Training Program in all capacities except those of medical, dental and advanced engineering students now in their respective schools.

The effect of this order on the dental school enrollment would be to reduce by 35 per cent the number of first-year students who would enter the classes admitted to most of the dental schools of the United States in 1945 and after. The ultimate effect of the order would be to reduce the number of dental graduates and to reduce materially the dental service available to the civilian population in the postwar period and to increase the patient-dentist ratio beyond the danger point; all of which would eventually lower standards in dental education and practice.

Sensing the catastrophic implications of such an action, a special committee presented the matter to the Trustees for attention, and on prompt action by the committee through the President, C. Raymond Wells, the order was modified to continue the dental educational program in all its relationships. President Wells and the special committee are to be highly commended for their alertness in avoiding what might well have been a professional calamity.

The recent survey of the dental schools by the Council on Dental Education revealed the fact that many of the schools depend to a large extent on the income from tuition and from clinics to maintain their

educational programs. All of the schools have accelerated their programs, and all have adjusted their procedures accordingly.

Some decades ago, the Government granted to the dental profession the opportunity to serve the Army through a health service designed to forward and sustain in a very material sense the usefulness and effectiveness of the military arm of the Government, and the development and perfection of the Dental Corps as an indispensable health service are the culmination of a long, tedious and, at times, trying effort of the dental profession exerted in the spirit of professional service and in the desire to serve humanity.

General Mills' report clearly and forcefully indicates the faithful manner in which this trust has been fulfilled by the profession. Moreover, a beneficial result from the preventive and corrective dental program now in operation in the Army and Navy will be that an enormous number of men heretofore dentally deficient will be rehabilitated for military service and a large percentage of them will return from war in improved physical condition as the direct result of improvement in dental health.

CORRECTION

In the article "Studies on Gramicidin and Related Substances: Bactericidal Effect of Tyrothricin on Oral Bacteria," by F. George Johnson, which appeared in THE JOURNAL for December 1, 1943, page 1909, the statement which follows was in the original manuscript and should have been included in the published article:

To Dr. Fred W. Morse, Jr., of the Department of Bacteriology of Harvard Dental School, the author is indebted for laboratory facilities and for many favors during the progress of the experiments. After completion of the experimental work and after Dr. Morse had entered the U. S. Public Health Service, the author, during the preparation of this manuscript, had the benefit of discussions with and criticisms from Profs. R. Dubos and J. H. Mueller and Drs. D. Weisberger and H. C. Trimble. Mr. V. J. Fields assisted with some of the experiments. To these individuals, the author expresses his indebtedness and appreciation.

1944 RED CROSS WAR FUND

When bombs fall, there is no time to send help half way around the world. When a badly wounded fighting man needs a transfusion, it is too late to begin looking for a blood donor or find a nurse to care for him. When a lonely soldier learns of trouble at home, he needs help—immediately.

The American Red Cross provides that help wherever and whenever the need arises. A continuous procession of blood donors must be maintained; nurses must be recruited for the Army and

Navy; trained Red Cross workers and supplies must be sent to camps, hospitals and foreign theaters of operation the world over.

When a train crash leaves scores injured, when flood engulfs a town, when epidemic strikes, delay may cost lives. Red Cross disaster relief and medical supplies, held in readiness for such emergencies, plus trained workers to rescue and assist victims and help in their rehabilitation, will prevent delay and thus save many lives.

To fulfil its many obligations to the armed forces and our people, the American Red Cross needs your help. During 1944, it must supply 5,000,000 blood donations. Each month, 2,500 nurses must be recruited for the Army and the Navy. Red Cross field directors and other trained personnel must be stationed at

military and naval posts and hospitals to help our fighting men and their families when personal trouble brews, a task in which the Red Cross chapter on the home front ably does its share.

At home, the Red Cross must continue to maintain a state of alert. Disasters must be met as they occur. Nurses' aides and first aiders must be trained and other educational projects continued. Food parcels for distribution to prisoners of war must be packed, surgical dressings made and the thousand and one details of administering a far-flung, busy organization must be attended to.

All activities of the American Red Cross are financed by voluntary gifts and contributions. During March, designated by President Roosevelt as Red Cross Month, the American Red Cross must raise its 1944 War Fund of unprecedented size to meet unprecedented needs. Your contribution will assure maintenance of all Red Cross services and thus indirectly help save many a life. Let's give.

PROCUREMENT AND ASSIGNMENT SERVICE INFORMATION WANTED

Information is again being sought on certain dentists known to be on active duty with the Armed Forces, but whose records are not complete. The information most necessary is the name of the state in which the dentist practiced prior to entrance on active duty. It is possible that the name is incorrectly spelled or an initial is wrong. Any information that can be given on the following dentists should be sent directly to Lt. Col. Kenneth R. Cofield, Surgeon General's Liaison Officer, 222 E. Superior Street, Chicago 11, Illinois.

Arnold, Milton (Army); Aurbach, Frederick (Army); Barfield, James A. (Army); Bowan, Clarence G. (Army); Brown, Bruce Everett (Army); Burman, Robert (Army); Carty, Joseph R. (Navy); Chalker, Everett M. (Navy); Claflin, William H. (Army); Dahn, Donald B. (Navy); Daniels, Robert J. (Army); Ellsworth, William (Army); Forrest, Martin A. (Army); Frieden, Julian H. (Navy); Gaines, Maxwell Livingston (USPH); Glick, Abraham H. (USPH); Hogen, Russell O. (Army); Hogge, Donald W. (Army); Jackson, Carl L. (Navy); Janney, Edward B. (Army); Jarbi, Frank C. (Army); Kanopka, John M. (Army); Kerans, Edwin G. (Army); Laisdell, Ralph C. (Army); Larson, Arnold D. (Navy); Larson, Arnold O. (Navy); Lea, Jack (Army); Lee, Johnson O. (Army); Marshall, Howard W. (Army); McFarland, Nelson (Army); McNab, John A. (Army); Merdell, Raymond M. (Army); Meyers, Warren C. (Army); Miller, Arthur L. (Navy); Miller, Joseph C. (Army); Mrozes, James E. (Army); Neuhaus, Joseph R. (Army); Nickolay, Stanley (USPH); Nicola, Quintus (Army); Patrelli, Frank G. (Army); Reinhold, Arthur (Army); Richardson, William (Army); Ryanes, David J. (Army); Slazberg, Leonard B. (Army); Tenaglia, Joseph L. (Navy); Tilman, Sam M. (Army); Varner, John C. (Army); Waggoner, William (Army); Weaver, Ernest L. (Army); Wieckert, Harold N. (Army); Wiggins, Joseph H. (Army); Young, Thomas R., Jr., (Navy).

ASSOCIATION ACTIVITIES

Contents

BUREAU OF PUBLIC RELATIONS

Variations in Dental Caries Rates Among White and Negro Children. Carl L. Sebelius 544

Atlas of the Mouth in Health and Disease 549

COUNCIL ON DENTAL THERAPEUTICS

Systemic Aspects of Diseases of Teeth and Oral Tissues. Lester W. Burkett 550

Federal Trade Commission Complaint on Colgate Dental Cream and Colgate Dental Powder 555

Accepted Dental Remedies 555

COMMITTEE ON LEGISLATION

Dentist Cleared of Charges of Malpractice 556

HORACE WELLS CENTENARY 558

COMMITTEE ON ECONOMICS

Costs of Dental Care for Adults Under Specific Clinical Conditions 559

COUNCIL ON DENTAL HEALTH

Progress Report of the Council on Dental Health 562

INSURANCE COMMITTEE

Progress Report 564

ARMY DENTAL CORPS

Engineers Improvise First-Class Dental Material 564

PROCUREMENT AND ASSIGNMENT COMMITTEE

Information Wanted 542

OBITUARY

George P. Evans (1892-1944) 565

DEATHS 565

BUREAU OF PUBLIC RELATIONS

VARIATIONS IN DENTAL CARIES RATES AMONG WHITE AND NEGRO CHILDREN

CARL L. SEBELIUS,* D.D.S., M.P.H., Nashville, Tenn.

FOR many years, characteristics of the white races and Negroes have been compared with various objectives in mind. In most cases, those comparisons concerning teeth are to the effect that Negro children have teeth with less dental caries than white children in a given area.

Because many findings in examining children of the preschool and school age groups of Tennessee since 1937 have been similar, a comparative analysis of the dental conditions of a large group of children will be presented in an attempt to ascertain whether such a relationship actually exists between them.

At this time, no attempt will be made to arrive at a conclusion concerning the reasons for differences in dental caries experience between racial groups, as, in my opinion, further study and research in the field of etiology of dental caries will be necessary before such conclusions can be drawn.

With data which have been gathered and compiled from 1937 to 1941 by me and by other members of the Dental Hygiene Service of the Tennessee Department of Public Health, an effort will be made to show significant differences in the conditions of the teeth of a sample group of children in twenty-four counties in the State of Tennessee. The material used includes dental records of 5,845 white and Negro children, matched by age and sex.

From a study of the literature concerning the dental caries experience of the white and Negro races, it appears that:

1. In general, Negroes seem to have a low dental caries incidence.
2. When statistical evidence is presented, there seems to be a consensus of opinion that the Negro experiences less dental caries than the white person.
3. Sex and geographic distribution may affect the dental caries experience of the two races.
4. Certain racial groups in a given area may have different dental caries experiences because of factors of immunity and heredity.

TENNESSEE STUDY

A. Method of Collection and Tabulation of Data.—The data used in the Tennessee Study represent the findings regarding the dental conditions in the mouths of 2,928 white children and 2,917 Negro children in twenty-four counties in Tennessee. Since there were originally more white than Negro children examined, all of the Negro children listed on the dental examination sheet were matched for sex and age by white children, county by county. The children examined represent not only those from families unable to pay for dental care, but also, from the economic standpoint, those from all classes of families.

The dental examinations were re-

*Director of Dental Hygiene Service, Tennessee Department of Public Health.

Abstract of a thesis submitted in partial fulfilment of the requirements for the degree of master in public health, University of Michigan, 1942.

corded as a part of the regular dental hygiene demonstration program which has been carried on by the Tennessee Department of Public Health in cooperation with the local county health departments since 1937.

All the data presented were entered on a definite type of record in a prescribed manner and the dental examination was conducted according to a standard technic. A carious defect was defined as any demonstrable area of decay involving one or more tooth surfaces. Pits and fissures were counted as carious defects if the explorer penetrated and caught in the defect.

Even though the records of four examiners have been used, the findings are thought comparable with but little variation, since I made more than 70 per cent of the examinations, and since, previous to the inauguration of each new dental demonstration unit in the state, the new dental officer spent a period of time with me to observe and discuss interpretation of dental conditions so that the examinations would be made in a similar manner.

From the dental examination summary sheets, the following data for each child were marked on mark-sensing tabulating cards with the use of a code:

1. Name of county.
2. Color.
3. Age.
4. Sex.
5. Need of dental care.
6. Fillings in permanent teeth.
7. Fillings in deciduous teeth.
8. Number of defects found in deciduous teeth.
9. Number of extractions indicated in deciduous teeth.
10. Number of defects found in permanent teeth.
11. Number of extractions found in permanent teeth.

TABLE 1.—TOTAL DENTAL EXPERIENCE OF 5,845 CHILDREN IN TWENTY-FOUR COUNTIES IN TENNESSEE BY AGE GROUPS

Age Group	No. Children	Total No. of Carious Missing and Filled Teeth	Number of Carious Defects	Number of Missing Permanent Teeth*	Number of Fillings Present	Dental Caries Experience with Standard Error†
White Children						
Total years	2,928	11,941	10,749	324	868	407.8± 3.73
3-5	46	215	215	0	0	467.4±31.87
6-8	988	4,817	4,604	27	186	487.6± 7.02
9-11	968	3,890	3,529	109	252	401.8± 6.44
12-14	715	2,255	1,804	137	314	315.4± 6.64
15-17	211	764	597	51	116	362.1±13.10
Negro Children						
Total years	2,917	9,119	8,750	344	105	315.3± 3.13
3-5	49	119	119	0	0	242.8±22.26
6-8	981	3,882	3,838	16	28	395.7± 6.35
9-11	961	2,883	2,791	72	20	300.0± 5.59
12-14	716	1,693	1,473	173	47	236.4± 5.75
15-17	210	622	529	83	10	296.2±11.88

*All permanent teeth indicated for extraction are considered missing permanent teeth.

†Dental caries experience includes the number of missing permanent teeth, number of carious defects and number of fillings present per hundred children.

12. Number of permanent teeth lost.
13. Name of examiner.

All averages in the study were calculated on units of 100 children in accordance with the method employed by the U. S. Public Health Service in similar studies conducted by Klein, Palmer and Knutson[1] at Hagerstown, Md.

B. Findings.—After the sorts were made, it became evident that a difference in the dental caries experience exists among the groups studied.

The following dental caries experience rates have been applied in a comparison of the Tennessee groups: 1. The total dental caries experience. 2. The deciduous tooth dental caries experience. 3. The permanent tooth dental caries experience. 4. The lost permanent tooth index as suggested by Wisan[2] in 1938.

Calculation of the total dental caries experience rates per hundred children, by the number of treated (filled) and untreated caries defects, plus the missing permanent teeth, seems to be an accurate method of determining the dental conditions found in order to make comparisons between white and Negro children. The total experience rates were further broken down into the dental caries experience rates in the deciduous teeth and the dental caries experience rates in the permanent teeth.

By age groups, the total dental caries experience rates per hundred children show highly significant differences. The white children in all of the age groups have a higher dental caries experience with a difference ranging from a maximum of 101.8±8.53, or 11.9 times its standard error in the 9-11 year age group, to a minimum difference of 65.9 ±17.68, or 3.7 times its standard error

TABLE 2.—DECIDUOUS DENTAL CARIES EXPERIENCE OF 5,845 CHILDREN IN TWENTY-FOUR COUNTIES IN TENNESSEE, BY AGE GROUPS

Age Group	No. Children	Deciduous Teeth				
		Total No. of Carious and Filled Teeth	No. of Carious Defects	No. of Indicated Extractions	No. of Fillings Present	Dental Caries Experience with Standard Error*
White Children						
Total years	2,928	6,290	4,778	1,332	180	214.8± 2.70
3-5	46	212	183	29	0	460.9±31.87
6-8	988	3,818	3,048	670	100	386.4± 6.25
9-11	968	2,022	1,432	534	56	208.9± 4.64
12-14	715	229	113	92	24	32.0± 2.12
15-17	211	9	2	7	0	4.3± 1.42
Negro Children						
Total years	2,917	4,767	3,694	1,040	33	163.4± 2.37
3-5	49	109	101	8	0	222.4-± 21.31
6-8	981	3,041	2,492	527	22	310.0± 5.62
9-11	961	1,470	1,025	439	6	153.0± 3.99
12-14	716	134	68	61	5	18.7± 1.62
15-17	210	13	8	5	0	6.2± 1.72

*Caries experience of deciduous teeth includes the number of carious defects, number of indicated extractions and number of fillings present in the deciduous teeth per hundred children.

in the 15-17 year age group. The total dental caries experiences rates are shown in Table 1.

The same is true in a comparison of the deciduous dental caries experience rates per hundred children by each age group with the exception of the 15-17 year age group as shown in Table 2, in which the standard error of the difference indicates that the sample does not give sufficient proof of an existing relationship. The differences range from a maximum of 238.5±38.17, or 6.2 times the standard error in the 3-5 year age group, to a minimum difference of −1.9±2.23, or 0.8 times the standard error in the 15-17 year age group.

Table 3 shows differences in the permanent tooth dental caries experience rates between the Negro and the white children, except in the 3-5 year age group, wherein the samples show an insufficient relationship. The white children showed consistently poorer teeth, the difference ranging from a maximum of 67.8±17.52, or 3.9 times the standard error in the 15-17 year age group, to a minimum difference of 13.9 ±7.46, or 1.9 times the standard error in the 3-5 year age group.

The lost permanent tooth index, or the number of lost permanent teeth per hundred children, is different from what might be expected, as shown in Table 4. However, when one notes that the Negro children are found to have few fillings, and if one considers the difficulties that many Negro children must overcome in

TABLE 3.—PERMANENT TOOTH CARIES EXPERIENCE OF 5,845 CHILDREN IN TWENTY-FOUR COUNTIES IN TENNESSEE, BY AGE GROUPS

Age Group	No. of Children	Permanent Teeth				
		Total No. of Carious, Missing and Filled Teeth	No. of Carious Defects	No. of Lost Permanent Teeth*	No. of Fillings Present	Dental Caries Experience with Standard Error†
White Children						
Total years	2,928	5,651	4,639	324	688	193.0± 2.58
3-5	46	3	3	0	0	6.5± 3.76
6-8	988	999	886	27	86	101.1± 3.19
9-11	968	1,868	1,563	109	196	193.0± 4.46
12-14	715	2,026	1,599	137	290	283.4± 6.30
15-17	211	755	588	51	116	357.8±13.02
Negro Children						
Total years	2,917	4,432	4,016	344	2	151.9± 2.27
3-5	49	10	10	0	0	20.4± 6.45
6-8	981	841	819	16	6	85.7± 3.0
9-11	961	1,413	1,327	72	14	147.0± 3.91
12-14	716	1,559	1,344	173	42	217.7± 5.51
15-17	210	609	516	83	10	290.0±11.75

*All permanent teeth indicated for extraction are considered missing permanent teeth.

†Caries experience of permanent teeth includes the number of carious defects, number of lost permanent teeth and number of fillings present in the permanent teeth per hundred children.

order to receive dental care, because of economic circumstances and the absence of dental facilities open to them, it is easier to understand why the lost permanent tooth index for all age groups for the Negro children is higher than for the white children. The Negro children were found to have a higher lost permanent tooth index in both the 12-14 and the 15-17 year age group, -15.3 ± 3.79, or 4 times the standard error, to a minimum difference of $1.1 \pm .66$, or 1.7 times the standard error in the 6-8 year age group. The minimum sample groups do not show sufficient evidence of a significant relationship existing between the two groups.

Table 4.—Lost Permanent Tooth Index of 5,845 Children in Twenty-Four Counties in Tennessee, by Age Groups

Age Group	No. of Children	Number of Lost Permanent Teeth*	Lost Permanent Tooth Index with Standard Error†
White Children			
Total years	2,928	324	11.1±0.62
3-5	46	0	
6-8	988	27	2.7±0.52
9-11	968	109	11.3±1.08
12-14	715	137	19.2±1.64
15-17	211	51	24.2±3.38
Negro Children			
Total years	2,917	344	11.8±0.63
3-5	49	0	
6-8	981	16	1.6±0.41
9-11	961	72	7.5±0.88
12-14	716	173	24.2±1.37
15-17	210	83	39.5±1.72

*Includes both lost and permanent teeth indicated for extraction.
†Number of lost permanent teeth per hundred children.

SUMMARY

1. Racial differences in dental caries rates have been noted in the dental literature.

2. The possibility that immunity and heredity may effect differences has been suggested in the literature and would seem to be one of the reasons that certain racial groups have different caries experiences.

3. Sex, age and geographic factors have been accounted for in this study, with an equal number of children in each county matched by age, sex and race.

4. The Tennessee Study shows that, in a comparison of 2,928 white children and 2,917 Negro children, the white children had more than eight times as many fillings as the Negro children.

5. A statistical analysis of the total dental caries experience shows significantly higher rates among the white children than among the Negro children.

6. Statistical analysis also shows that the white children aged 9-11, when compared with the Negro children of the same age, have a larger difference in the deciduous tooth caries experience than differences found in the permanent tooth caries experience.

7. The number of lost permanent teeth per hundred children, a measure used in evaluating dental care, shows that the Negro children had lost more permanent teeth than the white children.

CONCLUSIONS

1. Significant variations in the dental caries rates exist between white and colored children in Tennessee. The white children were found to have had the higher total dental caries experience.

2. Even though, in the Tennessee Study, the Negro children had a lower dental caries experience, they had lost more permanent teeth than the white children.

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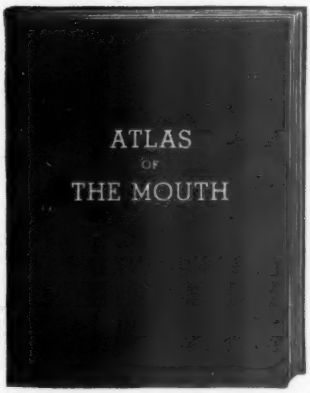
ATLAS OF THE MOUTH IN HEALTH AND DISEASE

THE Atlas of the Mouth, by Maury Massler and Isaac Schour, announced last month in THE JOURNAL, page 398, has been given a cordial reception by the profession. Displayed for the first time at the Chicago Midwinter Meeting in February, it was purchased by five out of six dentists who saw it.



Its value as a vehicle for patient education is unsurpassed. Its forty-nine full-page plates were selected by the authors primarily to illustrate the anatomic structures and physiologic conditions, as well as certain pathologic conditions, of the mouth that are of common interest to the dentist, the physician and the patient. Armed with the Atlas, the dentist can quickly and intelligently answer his patient's questions regarding most dental problems.

Space will not permit listing of all of the forty-nine subjects. A few are as follows: The Oral Cavity; Occlusion of the Teeth; Dental Caries; Effects of the Loss of a Tooth; Erosion, Hypoplasia; Progress of Periodontal Disease; Oral Diseases of Occupational Origin; Effects of Mouth Breathing; Muscles of Mastication, and Fractures of the Mandible and Their Treatment. The 180 illustrations (nineteen in color) were skilfully executed by Carl T. Linden. Each of the forty-nine plates is accompanied by a short interpretative text.

In accordance with its usual policy, the Bureau of Public Relations is offering the Atlas of the Mouth at $2.50 a copy. If it is purchased in lots of twenty-five or more in a single order, a 40 per cent discount may be had. Members of dental societies and others may pool their orders and thus effect a 40 per cent saving. Use the order blank on page A-56 of this issue and order now. The supply is limited.

COUNCIL ON DENTAL THERAPEUTICS

SYSTEMIC ASPECTS OF DISEASES OF THE TEETH AND ORAL TISSUES

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THE Council on Dental Therapeutics has authorized publication of this report as one of the series on pharmacology and therapeutics. The opinions expressed are those of the author and do not necessarily reflect the opinion of the Council.

DONALD A. WALLACE, *Secretary.*

A KNOWLEDGE of the systemic aspects of the diseases of the teeth and gingivae is clinically useful (1) for purposes of diagnosis, even though some underlying systemic condition is only suspected and (2) to facilitate cooperation with the physician in patient management in oral or systemic disease. The systemic aspects of lesions of the teeth and oral mucosa constitute so large a subject that it is impossible to discuss all phases in detail. An evaluation of the dental foci of infection alone would require more than the allotted space. It is hoped that a general discussion of oral medicine, its responsibilities and importance in dental practice, will arouse interest in this subject.

While it is not the province of the dental practitioner to diagnose systemic disease, it is his responsibility to consider dental disease in terms of its cause or its effect on the general health of the patient. This necessitates a basic understanding of the systemic diseases which may have oral manifestations or which may be modified by the presence of dental foci of infection. This is essential for treatment planning and for cooperation with the patient's physician. Familiarity with the systemic aspects of the various diseases should not lead the dentist to assume responsibility for their diagnosis or general treatment.

The teeth and their supporting structures and the oral mucosa are an integral and carefully integrated part of the human organisms. These structures are governed by the same physiologic principles and chemical processes that control other organs of the body. Pathologic processes in the teeth and associated structures are similar to those elsewhere except as they may be modified by structural, functional and environmental changes peculiar to the oral cavity. Because of these structural and environmental peculiarities of the tissues under consideration, their manifestations of systemic disease are frequently so early or so different from those observed in other tissues that they are not recognized as a part of the same process. Because of his familiarity with the normal appearance of the oral tissues, the dentist is in a unique position to detect these conditions early and, many times, also to detect subtle changes during periodic mouth examinations.

An understanding of the peculiarities of the dental tissues is necessary for the interpretation of clinical lesions. The teeth are covered with enamel, which is not only the hardest structure in the body, but also one which, once formed, has no reparative powers. The dentin, while somewhat analogous in composi-

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tion to bone, has structural differences, characterized by the lack of an intimate blood supply and a periosteal covering, which affect markedly its reaction to injury and its reparative potentialities. While studies utilizing the radio isotopes have demonstrated a slight mineral interchange in these tissues, for practical purposes it can be assumed that the fully formed, erupted or unerupted tooth is essentially unaffected by systemic disease except through changes in its external environment that may be associated with the systemic disease. The dentin and enamel of the formed tooth are little influenced by diseases that are characterized by skeletal demineralization, such as hyperparathyroidism, osteomalacia, Paget's disease and rickets.

The old belief that an increment of dental caries is associated with pregnancy has been scientifically disproved. One study even suggests that repeated pregnancies have a slight protective effect against caries. The internal administration of calcium salts is of no value in protecting the fully erupted tooth from caries or true erosion, and if given alone in large quantities, calcium or phosphorous salts may be harmful.

The effect of systemic disease on the enamel and dentin is most manifest during the early years of life. Enamel or dentin hypoplasia associated with endemic fluorosis, syphilis, rickets and the exanthematous fevers develops during odontogenesis. Hypoplasia associated with the last three conditions is probably not type-specific, but merely represents functional disturbances of the highly specialized odontogenetic tissues of varying intensity and duration.

Certain hereditary diseases, such as hereditary ectodermal dysplasia of the anhydrotic type, familial agenesia of certain teeth and hereditary opalescent dentin, affect these tissues. The last condition is at times associated with a curious and serious systemic disease, osteogenesis imperfecta, which is characterized by multiple repeated fractures of the bones. Icterus gravis will result in a permanent greenish yellow discoloration of the teeth developing during the time the disease is present.

In general, it can be said that the effect of systemic disease upon the enamel and dentin is of less clinical importance than are the many and varied changes manifested in the gums, the supporting tissues and the oral mucosa. This is due to the structural features of the enamel and dentin and their composition and lack of blood supply.

The gingivae, the periodontium and the oral mucosa present few structural peculiarities, but they are considerably influenced by the unusual environment of the oral cavity. The delicate mucosal tissues are constantly subjected to a wide range of chemical, thermal and mechanical insults during smoking or the chewing of food. These insults occur in a warm, moist environment which has a dense bacterial flora. These environmental peculiarities account for the high vulnerability of the gums, periodontium and oral mucosa and the rapidity with which lesions of these tissues undergo secondary changes and lose their distinguishing or characteristic features. This results in a "sameness" in the appearance of late lesions of varied etiology and causes difficulty in the diagnosis of old lesions.

Because of the varied insults to which they are constantly subjected, these tissues frequently manifest the presence of systemic disease long before the more common general symptoms are recognized. It is just as incorrect to consider all oral lesions as systemic in origin as it is dangerous to regard all oral lesions as local in origin. Here, as in other phases of dental practice, there is no substitute for experience, and the practitioner who has had the advantage of internship will have an appreciation and knowledge of the rela-

tionship of systemic to oral disease that it is difficult to obtain otherwise.

As our knowledge of oral disease increases, the importance of the systemic background of the patient is better appreciated. It should not be assumed that an oral disease is of local origin just because it responds to local treatment. This favorable response may be the result of an increased resistance of the oral tissues due to the elimination of local irritation, improvement in the circulation of the tissues or changes in oral hygiene. Local treatment may be effective, but if a systemic background is not eliminated, a recurrence of the lesion is likely. Modern dental practice should not substitute the "therapeutic test" for a careful history and diagnosis. If a history suggestive of systemic disease is obtained, the patient should be referred to a competent physician for study. While it is true that, many times, we cannot determine the systemic background even when there is one, this should not minimize our efforts to recognize those that can be detected.

It has been mentioned that the oral lesions associated with the various systemic diseases rapidly undergo secondary change and lose their characteristic features because of environmental factors in the oral cavity. This lessens the importance of the oral lesions as specific diagnostic aids, but it does not lessen their importance as early indicators of systemic derangement. The oral lesions, in a few conditions, are highly suggestive, if not diagnostic, of the underlying systemic disease. In this group are Koplick's spots, associated with measles, the fiery red, painful tip and lateral margins of the tongue seen in pernicious anemia, the oral lesions of frank nutritional deficiencies such as pellagra and scurvy, the mucous patches of syphilis, the marked hypertrophy and ulceration of the gingivae associated with acute leukemia, the punched-out, black-based ulcers of malignant neutropenia and the oral lesions of lichen planus. Local environmental factors may even modify the characteristics of these lesions to such an extent that the diagnosis must rest on the results of laboratory procedures.

The oral lesions in other systemic conditions clearly indicate a systemic background, but the actual disease entity cannot be so readily established. Included in this group are the oral lesions associated with the subclinical nutritional deficiencies, certain hormonal disturbances, especially gonadal, uncontrolled diabetes and other endocrine deficiencies, the osseous lesions of Paget's disease and the smooth tongue and glossopyrosis which frequently accompany gastric achlorhydria in the absence of pernicious anemia (Plummer-Vinson syndrome), as well as secondary anemia. In this group of diseases, the oral findings are at best suggestive, and considerable clinical and laboratory study is usually required to establish the systemic background.

In still another group of systemic diseases, the oral lesions represent merely a particular anatomic distribution, which is largely dependent, however, on the environment of the oral cavity. Included in this group are hemophilia, thrombocytopenic purpura, the hyperplasia and hypertrophy of the gingiva that frequently accompany dilantin therapy in the treatment of epilepsy, the oral changes associated with pregnancy, the oral changes in lipodystrophy (Christian's, Niemann-Pick and Gaucher's disease), the temporomandibular joint changes in rheumatoid arthritis, the submucosal petechiae that occur in bacteremia and the metastasis of tumors to the oral structures. Also included in this group are the oral mucosal lesions of the drug eruptions, erythema multiforme, lupus vulgaris, lupus erythematosus, herpes simplex (aphthous stomatitis) and scleroderma.

The tongue changes associated with

the various systemic diseases warrant special mention. In spite of the numerous examinations of this organ, it remains one of the least studied and least understood structures of the body. While the tongue is frequently the site of specific lesions, e.g. syphilitic, tuberculous and actinomycotic, the changes in most instances are not sufficiently characteristic to be diagnostically significant. The tongue condition is an excellent index of the constitutional state, but seldom of individual diseases.

The "non-specificity" of certain of the lingual changes, such as papillary atrophy, becomes more understandable as our knowledge of the physiologic and pathologic mechanisms underlying these changes increases. With such a background, it becomes more apparent why ariboflavinosis, aniacinosis or even iron deficiency anemia can result in papillary atrophy which may be clinically indistinguishable.

The average layman, physician and dentist are usually more concerned about coated tongue than atrophic lingual changes. The latter are almost always associated with rather serious systemic derangement, while coated tongue is more often of local origin and significance. Any dentist who has seen a tongue coating follow dental extractions, during which time there is a derangement of function of the oral tissues, is impressed with the importance of local factors in tongue coating. The tongue coating noted in gastro-intestinal upsets and protracted febrile diseases is more logically explained on the basis of a decrease in salivary flow and an inadequate mechanical removal of the continuously forming tongue coating due to an abnormal diet. The view that a coated tongue indicates constipation or auto-intoxication has been completely disproved by Crohn and Drosd.

A few diseases are peculiar to the tongue. Erythema migrans, or wandering rash, is a common tongue lesion the etiology and clinical significance of which are not known. Its differentiation from lichen planus of the tongue is easy if one only observes the day-by-day progress of the lesions in wandering rash. Glossitis rhomboidea mediana, a development anomaly of the tongue, is of little clinical significance, once the diagnosis has been made and the patient is assured that this peculiar lesion is benign. Painful or burning tongue may be a symptom of systemic disease, such as pernicious anemia, or it may occur as a local symptom complex or disease *sui generis*. In patients with glossodynia, a systemic background should always be ruled out, and then all possible local predisposing factors or causes of irritation be eliminated before a diagnosis of idiopathic glossodynia is made.

While the condition of the tongue is rarely of diagnostic significance, lingual changes in the form of papillary atrophy and changes in color and muscle tone furnish valuable information as to the general state of health of the patient. The tongue coating, essentially a local phenomenon dependent in part on a decrease in salivary flow, is an important indication of the general state of hydration of the body. The tongue should be carefully examined by the dentist as it is an indicator of deranged systemic function that may escape notice in a cursory examination of the oral cavity.

There is a large group of diseases which, as a rule, do not present actual lesions in the oral cavity, but which may be caused or considerably modified by dental disease. In this group, we have all the conditions related to focal infection. Those of particular interest to the dentist are subacute bacterial endocarditis, rheumatoid arthritis, secondary pulmonary infection, acute infection of the eyes, the kidneys, etc. It is difficult to evaluate dental foci of infection in these diseases and appraisal should not be

based on the opinions of the ultra-conservative or the radical. The many patients who have been made edentulous in the hope of curing some obscure ache or pain evidence the need for a more conservative attitude on the part of the physician and far more courage on the part of the dentist in ignoring instructions to remove all the teeth without exercising his professional judgment. On the other hand, the idea that a symptom-free tooth cannot be a focus of infection is just as fallacious and as dangerous as belief that a barking dog won't bite if he stops barking.

The main difficulties concerned with determination of the systemic importance of dental foci of infection are: (1) as yet, the dentist has no reliable means of determining whether a particular tooth or other dental focus is of systemic importance; (2) he has no definite means of determining whether secondary foci have already been established, and (3) he rarely sees a patient at a time when more conclusive results might follow elimination of oral foci of infection.

Much of the confusion about dental foci of infection has arisen from the particular interest in the pulpless tooth as a focus and the failure to consider periodontal disease as a more common and potentially more serious focus. The question of the pulpless tooth is one closely associated with lack of appreciation of the need for routine dental care. It will, it is hoped, be largely eliminated as the custom of periodic dental care becomes more widespread.

In respect to the pulpless tooth, it should be emphasized that a periapical radiolucent area on the x-ray film is indicative only of diminished radiopacity in this area. Infectious processes, either past or present, are common causes of such periapical changes, but by no means the only cause. While extremely useful in diagnosis, roentgenologic evidence of change is not the *sine qua non* in diagnosis of periapical infection. When these periapical radiolucent areas are compared with the serial histologic findings about the same teeth, it is revealed that the x-rays are of little value in determining the type of pathologic process or lesion present and that they may even furnish misleading information as to the actual size of the lesion. Furthermore, many of these periapical radiolucent areas yield no bacterial growth; and, to further complicate the problem, bacteria can be demonstrated in approximately 30 per cent of x-ray-negative non-carious teeth cultured *in situ*. The growth of bacteria from extracted teeth in cultures is by no means conclusive proof of their presence in the periapical region with the tooth *in situ* unless they are removed under sterile conditions, seldom met in practice.

In the last decade, numerous studies have demonstrated that the potential danger of periodontal disease as an oral focus of infection probably far exceeds that of periapical infection. It is important for the dentist as well as the physician to appreciate this dental focus of infection and to realize that, in many instances, periodontal disease is amenable to treatment and that its danger as a focus of infection can be eliminated.

Definite rules for the evaluation of all cases of oral foci of infection cannot be established. Each case requires individual consideration and evaluation, which are dependent on the age of the patient, the duration and severity of the symptoms, the importance of the extra-oral structures involved and the possibility and practicability of replacing the teeth to be removed. The last is frequently neglected.

This discussion of the systemic aspects of oral disease is offered in the hope that it will serve to remind the dentist that his field of practice is intimately related to the functioning of the entire body.

FEDERAL TRADE COMMISSION COMPLAINT ON COLGATE DENTAL CREAM AND COLGATE DENTAL POWDER

Colgate-Palmolive-Peet Co., Jersey City, N. J., is charged in a complaint issued by the Federal Trade Commission with disseminating advertisements which misrepresent the composition, properties and effectiveness of certain soaps, dentifrices and shaving creams that it manufactures and sells in interstate commerce.

In advertising its dentifrices, the complaint alleges, the respondent has falsely represented that both Colgate Tooth Powder and Colgate Dental Cream will make the teeth bright and sparkling; that the latter product, because of its "special penetrating foam," will remove food particles hidden between the teeth and thus avert unpleasant breath and tooth decay; that brushing the teeth with other dentifrices or using "ordinary" cleaning methods does not clean the teeth properly, and that all other dentifrices are "ordinary" or "common" by comparison with Colgate Dental Cream and are inferior thereto.

The complaint points out that the brightness and sparkle of the teeth depend on the qualities of the enamel, and the teeth of persons not possessing such qualities will not be benefited by the use of either the paste or the powder. Colgate Dental Cream, the complaint alleges, will have no effect whatever upon many causes of unpleasant breath, such as gastric disturbances, diet, dental caries and other conditions; it will not, in a large number of cases, make the breath sweet or pure, and will not avert decay; its "special penetrating foam" is soapsuds flavored with aromatic oils and will not accomplish the results claimed for it, and it possesses no inherent superiority over many other dentifrices.

Complaint 5126, February 7, 1944.

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

GLYCERIN AND RELATED COMPOUNDS*

Propylene Glycol, N.F.—Glycol Propyleneum (Glycol Propyl.)—Propylene glycol contains not less than 97.5 per cent by weight of racemic propanediol-1-2.

Propylene Glycol, N.F.—Carbide and Carbon Chemicals Corporation.—A brand of Propylene Glycol, N.F.

Manufactured by Carbide and Chemicals Corporation, Unit of Union Carbide and Carbon Corporation, New York, N. Y.

Admission of a product to the list of Accepted Dental Remedies does not imply a recommendation. It means that the product and the methods by which it was marketed at the time of consideration were not found to be in violation of the Council's published rules. Accepted products are reconsidered periodically. The files of the Council contain information on many drugs and dental cosmetics. All information is available, upon request, and inquiries are welcomed. A postal card will bring a prompt reply.

DONALD A. WALLACE, *Secretary*.

*A.D.R. Ed. 9, p. 135.

COMMITTEE ON LEGISLATION

DENTIST CLEARED OF CHARGES OF MALPRACTICE

A RECENT State Supreme Court decision dated January 10, 1944 absolved a dentist from charges of malpractice. A trial was held in the lower court upon the merits of the case, resulting in a judgment in favor of the dentist. The plaintiff appealed. The facts are as follows: May 18, 1937, the patient called at the office of the defendant dentist complaining of an aching tooth. The dentist extracted one of her teeth, presumably the aching one, after which the patient returned to her home. Two days later, May 20, as she was suffering considerable pain, she went back to the dentist's office and he examined her gums and prescribed a mouth wash and anacin to relieve the pain. She went home, developed considerable temperature, became alarmed and called in her physician, who operated May 22. The operation consisted of opening the floor of the mouth and the removal of pus, after which three incisions were made and tubes inserted for drainage purposes. The next day, the condition became worse and the physician felt that he was obliged at this time to make an incision the whole length of the neck, and to separate all the muscle tissues because the structures in the neck had already begun to turn black.

At the time that the tooth was extracted, the patient was accompanied by her mother, but at the time of the trial, neither the patient nor her mother was able to give any testimony as to what procedure was followed by the dentist. Under the circumstances, this is not unnatural since they were chiefly interested in the comfort and relief of the patient and not in the method by which the dentist removed the tooth.

The plaintiff, who was the father of the patient, charged that the dentist failed to use proper sterilization precautions prior to the introduction of the anesthetic into the patient's gums; that the dentist's instruments were not properly sterilized; that the treatment prescribed for the patient was not such as reputable dentists in good standing would have suggested; that, in refusing to call on the patient after being informed of her serious condition, he was guilty of negligence and, further, that in advising that the infection be undisturbed for six days, he was guilty of grave error.

The defendant testified that he had been the dentist for the patient's family for a number of years and that he was also a graduate doctor of medicine. He described the procedure followed by him in extracting the tooth as follows:

"I took a piece of cotton, saturated it with alcohol and phenol 5 per cent, and swabbed the surrounding tissues and the tooth. Then I took my hypodermic syringe from my sterilizer and inserted the carpule of novocain and proceded to give her an infiltration anesthesia. Before giving her the anesthetic, I always put my forceps that I chose for the extraction in my jar with a 25 per cent solution of phenol alcohol while I am giving this injection to insure again asepsis. After a matter of fifteen minutes, I took my forceps, which was in this solution, I shook the solution off from the forceps with a couple of licks, and I pulled the tooth out."

He contended that the precautions which he exercised were sanctioned by the best dental practitioners and he offered in substantiation of this statement the evidence of two other dentists and a doctor of medicine as a medical expert, all three of whom agreed with him.

The patient's physician testified that he was unwilling to say that the patient's infection was due to the improper sterilization of the needle by which the anes-

thetic was introduced into her gums. He testified that the human mouth cannot be thoroughly sterilized owing to the number of germs that are habitually present, such as saphrophytes, streptococci and staphylococci. He described the mouth as the filthiest part of the anatomy and stated that it contained ten times more germs than are found in the rectum. He did say that, in his view, the abscess had to be opened at once.

The dentist however testified that he advised against surgical interference until the sixth day after the beginning of an infection in order that the abscess might "point" or, as it is generally termed, in lay parlance, "come to a head."

The court noted that there was a contradiction between the statements of the dentist and of the patient's physician as to whether the abscess had to be opened at once or not. The court took notice of the fact that the two other dentists and the medical expert agreed with the stand taken by the dentist, and specifically mentioned that the medical expert, in the course of his testimony, had made the following statement: "I have never felt it desirable to open an abscess from a dental infection in less than a week after the beginning of that process. I do not mean after the extraction of the tooth; I mean after the beginning of the inflammatory process."

The evidence further revealed that the medical expert was asked to examine the hospital chart and to say whether there was anything in the condition of the patient which "would have prompted you as a surgeon to believe her condition was such as would warrant surgical interference," to which he replied "There is nothing in this record at any point on which you could decide that surgical interference should be undertaken." Also, in response to a question as to what he would have done, he stated that he would have waited for the localization of the abscess and of its approach to the surface. He testified that the result of the premature incising of an abscess would be to cause the infection to spread far beyond the area in which it existed at the time. In regard to the presence of fever, he was of the opinion that it was a favorable rather than an unfavorable symptom. The medical expert was also asked "What are the causes of dental abscesses," to which he replied: "I would consider by far the most important, infection already existing about the tooth; secondly, the pathogenic organisms which exist in the mouth; a very poor third, infection introduced in the process of the extraction of the tooth."

In applying the law to the foregoing facts, the court held, in effect, that:

The law with respect to the duties and liability of dentists, surgeons, and physicians is to the effect that they are liable for any injury caused a patient due to want of requisite knowledge or skill or because of the omission to use reasonable care and diligence in the application of such knowledge.

The great weight of authority is to the effect that in malpractice cases the skill and care of the dentist or physician will be presumed in the absence of any evidence to the contrary.

The law accords the medical practitioner the presumption that he has done his duty, and in a suit for injury caused by alleged malpractice the burden is on the plaintiff to prove the want of reasonable or ordinary care or skill. . . . The burden of proof is not shifted by showing an unsuccessful result has attended the treatment of the patient by the physician. Nor does the unsuccessful result of the case shift from the plaintiff to the defendant the burden of going forward.

The degree of care which the law exacts of dentists and physicians is that usually exercised by practitioners in good standing.

The rule is well established that a dentist or physician cannot be held liable for the death of a patient under his treatment, where there is no evidence to show negligence or lack of skill on his part, sufficient to overcome the prima facie case in his favor made by the evidence that the treatment adopted by him was the usual and customary one. The fact that a patient died under such cir-

cumstances does not raise any presumption of negligence or lack of skill on his part.

We conclude from our examination of the record, particularly of the expert testimony, that this dentist was not guilty of malpractice nor do we find any negligence in connection with the extraction of the tooth which is said to have caused all of the patient's distressing condition. As a matter of fact, as we have pointed out, by reference to the expert testimony it seems that an abscessed tooth is much more likely to have been caused by the organisms which are commonly to be found in the mouth, or infection existing about the tooth at the time of extraction than by the introduction of an unclean instrument by a dentist in the process of anesthetizing the gums and preparatory to the extraction of the tooth.

The Supreme Court thereby upheld the judgment of the lower court in favor of the dentist.

GEORGE H. FOX, *Secretary and Legal Advisor*
Committee on Legislation

HORACE WELLS CENTENARY

MEMBERS of the dental profession here will this year join with their colleagues throughout the United States in commemorating a discovery, 100 years ago, that revolutionized dentistry, medicine and, especially, surgery.

It was exactly a century ago, December 11, 1844, that Horace Wells, a Hartford, Conn., dentist, first demonstrated and announced to the world that nitrous oxide could be used to make the human body insensible to the pain associated with dental and other surgical operations.

Plans for a national centennial celebration in Hartford next fall and for observances in all parts of the country during the year were reported in the March issue of THE JOURNAL.

The centenary program will be sponsored by the American Dental Association through a national committee headed by Eugene M. Clifford, Hartford, and comprising Frederic T. Murlless, Jr., Hartford; L. Pierce Anthony, Chicago; W. Harry Archer, Pittsburgh; Don J. Aubertine, San Francisco; B. Lucien Brun, Baltimore; Paul H. Jeserich, Ann Arbor; Walter T. McFall, Asheville, N. C.; W. E. Mendel, Pittsburgh; Robert L. Sprau, Louisville; T. I. Way, Cincinnati; W. J. Gies, New York; Arthur H. Merritt, New York; Howard R. Raper, Albuquerque, N. M.; Oren A. Oliver, Nashville, and W. N. Hodgkin, Warrenton, Va.

Before Dr. Wells' discovery, in 1844, practical anesthesia in surgery was unknown. Dr. Wells, long concerned regarding the pain associated with surgical operations, had been seeking a drug that would deaden that pain when, December 10, 1844, at an entertainment given in Hartford by an itinerant lecturer, Gardner Colton, he saw at first hand the pain-killing effects from inhalation of nitrous oxide.

The next day, Dr. Wells courageously inhaled an unusually large amount of the gas and had one of his teeth extracted by John M. Riggs, to confirm the evidence that extraction could be carried out without pain.

Dr. Wells did not maintain that he was the discoverer of the anesthetic properties of nitrous oxide, but he did hold that he was the first to demonstrate and proclaim its use to render surgical operations painless.

He did not achieve great personal success in spreading the knowledge that he had gained, nor did he enjoy any financial reward from his discovery, but his efforts, bearing fruit after him, changed the course of dental and general surgery and became of inestimable value to mankind.

EUGENE M. CLIFFORD, *Chairman*
WALTER T. MCFALL,
Chairman of Publicity
Horace Wells Centenary Committee

COMMITTEE ON ECONOMICS

COSTS OF DENTAL CARE FOR ADULTS UNDER SPECIFIC CLINICAL CONDITIONS*

STUDENTS of dental economics have evinced a great deal of interest in the recently published monograph "Dental Care for Adults." This study, made under the auspices of the American College of Dentists, presents the detailed findings on actual cost and time required to provide regular, adequate care to a group of 485 low-income patients at the Dental Health Service clinic in New York City. It is the first study made which distinguishes initial needs and maintenance care needs over a period of years.

The Dental Health Service was established almost twenty years ago as a clinic for the indigent. About thirteen years ago, it was reorganized as a non-profit pay clinic for the low-income group. Its directors in 1941 included the following dentists: James M. Dunning, who served as president, Henry W. Gillett, John Oppie McCall, Arthur H. Merritt, Waldo H. Mork, who served as professional supervisor, Harry M. Moss, Henry C. Slatoff, Harry Strusser, Russell W. Tench and Maurice William.

The normal staff at that time consisted of eleven part-time dentists, one part-time professional supervisor, six full-time dental nurses, including three hygienists, and an executive secretary. Dentists served an average of thirteen hours weekly, and were paid at the rate of $2.16 per hour. On an equivalent full-time basis, their salaries would have been $4,320 annually, about $600 above the average income of dentists in 1941. Hygienists were paid at the rate of 62 cents per hour, or $24.80 for a forty-hour week.

Service, which was confined mainly to adults, included all regular operations. In 1939, about 15 per cent of those admitted were reported as having no regular income. The average income of the remainder was about $23 a week. The group is not fully representative of the portion of the national population usually recognized as low-income workers, being composed mainly of sales persons and office workers. About 2,500 patients were treated yearly, of whom two-thirds were women. In thirteen years, the clinic has served more than 21,000 different patients in more than 200,000 visits. The popularity of this clinic is reflected in the fact that, since 1939, it has been treating more former patients than new patients.

All new patients are required to have a full x-ray examination, clinical examination and prophylactic treatment before any operations are performed. Fillings are mainly of the amalgam or cement type. Only one gold foil was placed in thirteen years. Prosthetic work consists mainly of the less expensive types of full or partial dentures and removable bridges. In fact, only one acrylic denture and three gold partial dentures were fitted in 1938. Very little crown work is done.

Fees are moderate, generally falling slightly below the rates established by the U. S. Public Health Service and the Veterans Administration. One-surface amalgam fillings cost $2, two or more surface fillings, $3 (subsequently raised to $3.50). The rate for prophylaxis is $2.50. There is no charge for examination or treatment of minor gum conditions.

*By Dorothy Fahs Beck. Published under the auspices of the Socio-Economics Committee of the American College of Dentists, 1943; 306 pages.

In reviewing the clinic's patient records, the survey group was able to find almost 500 patients, each of whom had received regular treatment over a period of four or five years. From these, it was possible to compile averages on services needed, initial and maintenance time and cost to the clinic of providing these services.

At regular adult fees, initial care received by these 485 patients cost an average of $52.66, of which $23.78 was for prosthetic work; $19.37 for fillings; $3.20 for extractions, and $6.01 for x-ray films, prophylaxes, examinations, miscellaneous treatments and services of specialists. If prophylaxes and full mouth x-ray examination had been given to all during initial care with recommended frequency, these additional services would have raised the average total bill for essential initial care to $55.23. If cost of services received had been at typical low urban private fees instead of those at the Dental Health Service, the average initial bill would have been about $68.34. On a similar basis, all recommended services would have cost $71.34.

After initial care had been completed, cost of services decreased. The greatest decline occurred in extractions and new replacements; the least, in diagnostic and preventive services. During an average maintenance year, care received cost these patients $10.05; $13.26 with appropriate correction. The estimated figures for the same care at low urban private fees were $12.62 for services rendered or $16.05 for all services recommended.

It was estimated that the initial care received by these patients cost the clinic $46.60, or $6.06 less than the average bill to the patient, yielding the clinic a surplus. However, the maintenance care of these patients was provided at a net loss of $1.09. Thus, for a period, surpluses from initial care were sufficient to offset the losses on maintenance care; but if these patients had continued maintenance care beyond this period, net losses would have resulted for the clinic unless the potential losses were counterbalanced by surpluses from initial care for new cases.

The clinic found that it was not covering the costs of prophylactic treatment during initial care at $2.50 a treatment, even though the prophylaxis was given by a hygienist. Examination and minor gum treatments for which there was no charge resulted in a loss of almost $4 hourly. In the maintenance period, however, there was nearly a balance between the established fee and the cost of providing prophylactic service. X-ray work at $3 or $3.50 covered overhead and material costs and the salary of the technician, an excess of income over costs. Fillings were provided at approximate cost. Prosthetic service, while provided at a moderate fee, gave a return of about $9 per hour of service at a cost of $4.50 per hour. The surplus resulting from this activity covered the losses experienced in examinations, minor treatment and extractions. The employment of auxiliary workers by the Dental Health Service permitted the most effective use of its professional manpower and protected it from a possible deficit.

Amounts of chair time required for initial and maintenance care were determined. The average for all patients was about 8.5 hours, of which about 7 represent work of the dentist; the remaining time, that of hygienist, and the x-ray technician. If all recommended services had been obtained, the average total chair time would have been increased to 9.4 hours per patient.

During maintenance care, the average patient annually received 2.4 hours of chair service at the clinic, of which 1.7 were with the staff dentist, the rest being spent with the hygienist and the x-ray technician. If all patients had received all recommended prophylaxes and

x-ray examinations, maintenance time would have been increased to 3.6 hours annually.

The average patient needed 2.5 extractions, 7.5 fillings, 1.8 prophylaxes and 1.0 full mouth x-ray examination before initial care was concluded, if completion of all recommended services is assumed. New dentures, including both full and partial, numbered fifty-five per hundred cases. Other services, such as insertion of fixed bridges and inlays, were very infrequent because the clinic policy permits these types of service in exceptional cases only.

During maintenance care, extractions fell to fifteen per hundred persons per year, only one-forty-fifth of the number in initial care. New partial dentures reached the low level of 3.2 per hundred per year. Fillings decreased to an average of 2.1 per person per year. Partial remakes, repairs and adjustments of dentures were more numerous during an average maintenance year than in initial care.

Older persons in general, as compared with younger adults, had high initial costs. In contrast, older persons had lower maintenance costs, probably in part because they had fewer natural teeth requiring attention, and in part because the incidence of caries is lower at the higher age levels.

There were significant differences in needs by sex, although of lesser magnitude than when related to age. Men had higher initial needs than women at most age levels and for most types of service, owing presumably to the tendency of men to neglect their teeth. Probably because of a greater need for artificial replacements, the initial care for men yielded a larger surplus to the clinic. During maintenance care, the reverse was noted. In other respects, needs by sex were nearly similar under maintenance conditions.

An interesting and comprehensive introduction traces the development of thinking on the problem of distribution of dental and medical care. In addition, the authors present an excellent evaluation of former studies of the incidence and prevalence of dental disease, as well as of the various estimates of cost and time. In this respect, the study can serve as a useful reference for persons interested in reviewing the wealth of material that has accumulated in recent years.

"Dental Care for Adults" is a major contribution to the growing file of information on dental economics. It will undoubtedly have an important influence upon the thinking of the leaders in the dental profession and upon others concerned with the problem of financing and distributing dental care. It points the way for subsequent and necessary studies in this field. Its limitations come not from internal weaknesses, for there are few, if any. It is unfortunate, however, that the group of cases in this study represents a relatively small sample of a limited social and economic segment of the general population in a single metropolitan area. The experience of this clinic in providing standard service and moderate fees should be of vital interest to groups interested in planning similar clinics. In addition, such findings should be of value to groups studying problems related to the establishment of prepayment plans. While this study alone cannot provide a complete and accurate answer, its findings, together with additional research, will be the basis of ultimate decisions about the feasibility and mechanics of such plans. Finally, the technics used in ascertaining the time required to provide and unit costs of providing specified services are certainly recommended for study by those comtemplating similar surveys.

An interesting point revealed by this study was that of the 21,000 patients

served in the thirteen-year period, only about 2 per cent (the 485 cases covered in this report) were found to have returned for regular adequate service for even four years. While this fact is open to various interpretations, it is in itself a significant social commentary.

LESLIE M. FITZGERALD,
Chairman.
J. E. BAGDONAS, *Secretary.*

COUNCIL ON DENTAL HEALTH

PROGRESS REPORT OF THE COUNCIL ON DENTAL HEALTH TO THE A.D.A. BOARD OF TRUSTEES, FEBRUARY 19, 1944

To the Board of Trustees:

The Council on Dental Health is, at the present time, in session and is considering the problems assigned to, and the reports of, its various committees. Because the Council as a whole has not as yet had an opportunity to make any recommendations resulting from its subcommittee activities, we desire to make only a progress report at this time.

The Executive Committee of the Council on Dental Health has held two meetings since October, at which time plans were devised for accelerating the activities of the state and component councils on dental health as well as those of the A.D.A. Council itself.

The Low Income Group Committee has prepared and submitted a comprehensive preliminary report to the Council. It presents objectives and principal methods for conducting dental treatment programs for that segment of the population unable to pay private dentists' fees for themselves and their families. As soon as the Council as a whole has had an opportunity to study this report in detail, the results of the deliberations will be submitted to the Board of Trustees.

Because of a change in chairmanship, the activities of the Social Trends Committee have been somewhat curtailed. Nevertheless, the gathering of information on social trends, which is one of the principal functions of this committee, has gone forward.

Our Council wishes to thank Mr. Fox, secretary of the Committee on Legislation, for his cooperation in this matter.

The Prepayment Committee is exploring the possibilities of establishing an experimental prepayment dental program preferably in connection with an existing hospital or medical prepayment plan. The committee, with the assistance of the Committee on Legislation, is studying the various state laws to determine in which states a dental prepayment program could be inaugurated without the enactment of special legislation.

The Victory Corps Committee has done an excellent job in stimulating state and component dental societies to cooperate with state health and educational officials in the promotion of the High School Victory Corps Physical Fitness Dental Program. Forty-two state dental societies have established Victory Corps Committees, most of which are functioning on a state-wide basis. Special articles have been prepared for and published in national and state health and educational magazines, as well as in all dental society journals.

The Industrial Committee is making gratifying progress in promoting greater appreciation by industrial health workers of good dental health for employes.

The chairman of the committee was invited to attend the Annual Congress on Industrial Health in Chicago, February 15 and 16, and the committee was requested to present an exhibit at the same meeting. Plans are also under way to present a paper and an exhibit on dental occupational diseases at the meeting of the American Association of Industrial Physicians and Surgeons in May. The interest in industrial dental programs is growing rapidly and the Council anticipates much future activity in this field.

The Research Committee is working very closely with the Caries Control Committee in the formulation of the latter's plans. In formulating its proposal to establish caries control programs on a national, state and local level, the Caries Control Committee recognizes the fact that much preliminary education among the dentists is necessary and much groundwork must be done before the project can be successfully launched.

The Professional Relations Committee has been very active since the October meeting. It has released to the profession, through THE JOURNAL and state journals and directly to the state councils, at least one monthly article or brochure dealing with Council activities and designed to promote state council activities. The original pamphlet entitled "Councils on Dental Health" received considerable commendation for its helpfulness in clarifying Council purposes and organization. The committee has revised the copy and a second edition is being ordered. The committee is also revising the pamphlet entitled "Programs for Dental Health," originated by the National Health Program Committee. The second edition will be available within the next ninety days. This committee is also cooperating with all of the other Council committees in the preparation of a brochure on each committee's activities.

The Public Relations Committee, cooperating with the Bureau of Public Relations, has had a very full program since making its last report. The new series of thirteen radio electrical transcriptions, "Tales from Ivory Towers," has been completed and announced to state and component dental societies.

A dental lecture entitled "Dental Facts for Fighters," for men in the armed forces, and two new reprints, "Questions and Answers on the Care of Children's Teeth" and "Diseases of the Gums and Other Supporting Tissues of the Teeth and Their Treatment," have been added to the Bureau's stock.

In cooperation with the Victory Corps Committee and the Bureau, a new motion picture film entitled "The Student Flyer" has been prepared for use in the Victory Corps Dental Program. This project was financed by the Weco Products Company and our committee is appreciative of their financial support.

The committee also is pleased to report that the new Atlas of the Mouth, prepared by Maury Massler and Isaac Schour, and distributed by the Bureau of Public Relations, is just off the press. The committee sincerely feels that this new Atlas with its 180 illustrations will be an effective aid in the field of dental health education.

If, out of its deliberations during this meeting, the Council on Dental Health should formulate certain recommendations, we trust that we may have the privilege of presenting them at a subsequent hearing.

EMORY W. MORRIS, *Chairman,*
Council on Dental Health.

INSURANCE COMMITTEE

PROGRESS REPORT

To the Board of Trustees of the American Dental Association:

FIVE years ago, the Insurance Committee mapped out a program, setting up the goal of building the A.D.A. Group Insurance Policy to a total of $25,000,000 of insurance in force by the end of 1944. This required a net increase of approximately $7,000,000. We are pleased to advise that we are ahead of this schedule and expect to reach that goal before July 1, 1944.

We are greatly elated by the results of our work, not only from the viewpoint of volume, but from the viewpoint of stability and increased benefits as well. During the five years just passed, we have been able, in cooperation with the Insurance Company, to greatly liberalize the conversion privilege and, effective January 1 of this year, a double indemnity benefit was added for the benefit of every group insurance policyholder irrespective of age or physical condition, without cost. The effect of this new coverage is to double the amount otherwise payable, in event of death from certain accidents.

Our lapse record is apparently as low as at any time during the past five years, but exact figures cannot be given at this time.

Since the inception of the A.D.A. Group Insurance, benefits have been paid totaling more than $2,780,000. This is as of February 1, 1944.

This progress report is offered by your committee chairman, with thanks to the Board of Trustees and the Officers of the A.D.A. for their assistance and cooperation.

A. D. WEAKLEY, *Chairman.*

ARMY DENTAL CORPS NEWS

ENGINEERS IMPROVISE FIRST-CLASS DENTAL MATERIAL

BEING a dentist for an Engineer Regiment has its advantages in the opinion of Capt. Alex Grower, aged 35, 267 Main St., Portland, Conn., now in England. The engineers make dental instruments and equipment otherwise unobtainable.

"Sometimes equipment is slow in arriving overseas," said Captain Grower, "but we never worry about that. So far, the engineers have built or created everything I've asked for, and have done a mighty good job."

He listed a hydrocolloid mixing syringe, chisels, curets, adaptors for lights, electric motors for drills and parts for handpieces as items made to order for him by some of the men.

"I usually draw a diagram of what I want or show the men a picture of the instrument or equipment in a dental journal," he disclosed, "and they use whatever materials they have on hand to turn it out."

Members of the regiment who have adapted their skill to manufacturing dental equipment are Cpl. Ralph E. Weimer, 31, Girard, Ohio; Cpl. Charles E. McBride, Jr., 27, 821 W. 9th St., East Liverpool, Ohio, and Pfc. Paul Burt, 21, Route No. 1, Belle, Mo.

OBITUARY

GEORGE P. EVANS

(1892-1944)

GEORGE P. EVANS died suddenly, January 28, at his home in Jackson, Miss., at the age of 51 years.

Dr. Evans was born in Pennsylvania, but spent his boyhood in Illinois, coming to Mississippi in early manhood and settling in Columbia. About twelve years ago, he moved to Jackson, where he specialized in orthodontia and children's dentistry.

His early education was received in the public schools of Illinois and later at Lake Forest College and Vanderbilt University School of Dentistry.

Dr. Evans was an active member of the First Presbyterian Church here. He was also active in the Jackson Rotary Club and in all matters connected with the dental profession.

He not only served as secretary and president of the Mississippi Dental Association, but also had been chairman of the Dental Procurement and Assignment Board since its inception. At the time of his death, he was chairman of the Mississippi Dental Association's Council on Dental Health, and was a member of the International College of Dentistry.

Tireless in his efforts to lift his profession to the highest levels of public service, Dr. Evans was still interested in the problems of each individual dentist in the state. To the younger men, he was an example of all that is clean and honorable, sincere and understanding, yet he was unfaltering in the courage of his convictions. To the older men who knew him intimately, he was an inspiration.

Surviving him are his wife and a young son, George, Jr., and his father, two sisters and three brothers in Illinois.

DEATHS

ALLEN, WILLIAM A., Billings, Mont.; Kansas City Dental College, 1897; died January 24; aged 95.

BAKER, WILLIAM B., Bristol, Pa.; died February 4; aged 73.

BALDWIN, LOUIS C., Los Altos, Calif.; New York College of Dentistry, 1890; died January 4; aged 75.

BROADSTREET, ALLEN W., Indianapolis, Ind.; died February 11; aged 54.

BUTTER, A. B., Edina, Minn.; University of Minnesota, College of Dentistry, 1907; died February 7; aged 59.

CRAIN, LOUIS F., Missouri Valley, Iowa; State University of Iowa, College of Dentistry, 1898; died January 29; aged 72.

DEAR, E. J., Erie, Pa.; Pennsylvania College of Dental Surgery, 1908; died January 24.

DICK, WILLIAM, Lansing, Mich.; University of Michigan, College of Dental Surgery, 1902; died January 27; aged 70.

DOBSON, JAMES F., New Britain, Conn.; Baltimore College of Dental Surgery, 1915; died January 28; aged 51.

DONOVAN, E. J., Wakefield, Mass.; Tufts College Dental School, 1909; died February 10; aged 55.

DURKIN, JAMES J., Olneyville, R. I.; Pennsylvania College of Dental Surgery, 1907; died February 9; aged 64.

ENGLISH, RAY A., Clay City, Ind.; Chicago College of Dental Surgery; died January 25; aged 62.

EVANS, GEORGE, Jackson, Miss.; Vanderbilt University, School of Dentistry, 1924; died January 20; aged 51.

FOWLER, CHARLES S., Watertown, N. Y.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1901; died February 12; aged 66.

FREEBURGER, GEORGE F., Juneau, Alaska; North Pacific College of Oregon, School of Dentistry, 1915; died January 23.

GODFREY, J. MORRIS, Richmond, Utah; University of Southern California, College of Dentistry, 1927; died January 9; aged 42.

GRANETZ, ABRAM B., Washington, D. C.; School of Dental and Oral Surgery, Columbia University, 1939; died February 6; aged 34.

GREEN, HARRY J., Paragould, Ark.; Washington University School of Dentistry, 1905; died December 21; aged 63.

HAMILTON, J. W., Minot, N. D.; Northwestern University Dental School, 1917; died February 3; aged 53.

HARRELL, WALTER W., Kansas City, Kan.; Western Dental College, 1909; died January 23; aged 63.

HARSHMAN, VERN S., Flint, Mich.; University of Michigan, College of Dental Surgery, 1915; died February 15; aged 54.

HAUGHT, STEPHEN M., Kansas City, Kan.; Western Dental College, 1906; died February 11; aged 63.

HICKS, JOHN H., Greenville, S. C.; Atlanta Southern Dental College; died January 20; aged 42.

HUSKEY, CHARLES F., Albany, Texas; State Dental College, Dallas, 1910; died December 30; aged 59.

JOHNSON, A. F., St. Louis, Mo.; Des Moines College of Dental Surgery, 1902; died February 3; aged 66.

JOHNSON, ALBERT M., St. Louis, Mo.; died February 8.

JONES, WILL L., Seattle, Wash.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1890; died January 29; aged 77.

JORDAN, JOHN EDWARD, Warren, Pa.; Temple University School of Dentistry, 1896; died January 23; aged 78.

JULIAN, WILLIAM, Indianapolis, Ind. (formerly of Trenton, N. J.); Temple University School of Dentistry, 1908; died February 6.

KUHNE, LOUIS, College Point, N. Y.; Columbia University Dental School, 1924; died January 31; aged 46.

LORD, CHARLES N., Long Beach, Calif.; Temple University School of Dentistry, 1892; died January 29; aged 75.

MCCONNEL, CHARLES W., Boston, Mass.; Temple University School of Dentistry, 1880; died February 11.

MCDONALD, PAUL H., Georgetown, S. C.; Atlanta Dental College, 1910; died January 21; aged 55.

MCNALLY, EDMUND J., Palmer, Mass.; Tufts College Dental School, 1909; died January 28; aged 65.

MASSEY, JEWETT W., Quitman, Miss.; Atlanta Southern Dental College; died January 28; aged 34.

NEWELL, ROBERT, Tampa, Florida; died February 2.

NOONAN, KAEN A., Allston, Mass.; Tufts College Dental School, 1906; died February 2.

PATTERSON , JOHN F., Geneva, Switzerland (formerly of Syracuse, N. Y.); died February 12.

PRITCHARD, WILLIAM C., Canton, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1907; died January 23; aged 60.

PROCYK, JOHN, McKees Rocks, Pa.; University of Pittsburgh, School of Dentistry, 1922; died January 31; aged 54.

PUTNAM, HARRY WELLS, Topeka, Kan.; University of Michigan, College of Dental Surgery, 1903; died February 13; aged 65.

RIGGLEMAN, JESS A., Los Angeles, Calif.; Harvard University Dental School, 1925; died February 10.

ROGERS, J. M., Buhl, Idaho; died January 20; aged 74.

SEARCH, J. T., San Bernardino, Calif.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1895; died January 25.

SHACKELFORD, GEORGE W., Augusta, Ga.; Atlanta Dental College, 1898; died January 31.

SHULER, Max, Charlotte, Mich.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1901; died February 1; aged 67.

SMITH, WILLIAM DEFORD, Steubenville, Ohio; Ohio State University, College of Dentistry, 1914; died December 24; aged 59.

SMITH ,WILLIAM, Tunkhannock, Pa.; Pennsylvania College of Dental Surgery, 1904; died January 30; aged 70.

CURRENT LITERATURE

Differential Diagnosis of Vincent's Infection

ALLEN M. OLINGER, JR., and JOHN E. RHOADS

VINCENT'S infection is the only communicable disease for which the dentist is responsible in diagnosis and treatment. It is, therefore, of interest to note its pathologic relationship to other diseases presenting similar symptoms. The disease, known by many other names, but commonly as Vincent's disease or trench mouth, has been diagnosed in recent years either because it has actually become more prevalent and its symptoms have become more familiar to doctors and dentists or it has become more familiar to the general public. Its exciting cause is the invasion of the gingivae by the spirochete *Borrelia vincenti* and *Fusobacterium plauti-vincenti*. Its predisposing cause may be the result of improper mouth hygiene. Its stages of development are four, beginning with inflammation and ending with pseudomembrane formation. There are local and constitutional symptoms. The disease is endemic, but may become epidemic under proper conditions. It is comparable in its different stages to the following diseases: diphtheria, blood dyscrasia (lymphatic leukemia, agranulocytosis and myelogenous leukemia), syphilis and leukoplakia, yet it is different from all in one or more important respects.—*Contact Point*, 9:261-271, May 1942.

B. WEINSHENKER.

Do's and Don'ts of Opening the Bite

EUGENE B. COWAN and HOWARD L. MARIN

MOST teeth are not lost from decay, but from periodontal disease from malocclusion resulting in loss of the vertical dimension. Loss of the vertical dimension is caused by excessive wear, extractions, loss of occlusal antagonists and other conditions resulting in impaired muscular function and changes in bony structure. Restoring the maxillomandibular opening is a prime problem in dentistry, not only from an esthetic standpoint, but also in the establishment of muscular equilibrium. A special training is required to complete a new dental mechanism. Considerations in the restoration are determining the degree of opening tolerated, obtaining a centric maxillomandibular relation that will remain permanent and the rebuilding of the occlusal surfaces.—*Contact Point*, 20:69, September 1942.

MELVIN CAMPOS.

Some Facts of Permeability of Enamel

K. H. FERGUSSON

THE fact that teeth have their greatest tensile strength in youth and that strength decreases with age and does not depend on the density of the calcium salts, but rather the condition of their organic constituents, emphasizes several facts. Some schools of thought believe enamel receives nutrient material from the blood stream through the pulp and dentin, while others believe that nutriment comes through the saliva. This question has not been settled. There is evidence supporting both theories.

In the light of present knowledge, several conclusions can be drawn. The enamel of a recently erupted tooth is far more permeable than that of the mature tooth. Permeability of enamel is in relation to organic content and condensation after eruption. Enamel acts as a semipermeable membrane. Therefore, the general health would control the concentration of the different material in the blood stream and saliva, thus having a profound effect on the condition of the teeth.—*Contact Point*, 20:171-175, December 1942.

H. C. MERIGAN.

Compound Composite Odontomas

T. L. ROBERTS and K. S. LOUIE

AN odontoma, a tumor composed of two or more tissues of the tooth germ, is subject to variation in composition. In Thoma's classification, the odontoma falls into the general classes of mature, benign or calcified, each of which can again be subdivided. The odontoma contains all the tissues of the tooth germ. Its origin is not definitely known, but

it is thought to be the result of perversion of the dental epithelium. It may occur in either jaw. It may contain from three to five hundred small toothlike structures. Treatment consists of surgical excision of the tumor. Removal is recommended because of the effect of the lesion on the bone and remaining teeth.—*Contact Point,* 21:108-112, September 1943.

HARRY L. HARWOOD.

The Amalgam War and Its Modern Echoes

WILLIAM F. STOLKER and JAMES G. CAMPBELL

THE early history of amalgam was influenced by charlatans, who, by their unethical practice, cast an undesirable light on the amalgam restoration. After a lapse of its popularity, a few alert and far-sighted dentists, realizing its possibilities, carried out endless experiments, which resulted in the quality and popularity of the filling today. The one man who is largely responsible for the advancement of amalgam is G. V. Black, whose untiring efforts were meritorious in every phase of dentistry. The present success of amalgam is due to the use of a balanced alloy, with careful manipulation and cavity preparation and proper finishing and polishing. When these are carefully carried out, silver amalgam becomes one of the best restoratives known to the dental profession today.—*Contact Point,* 20:259-263, March 1943.

WILTON I. LITWINENCO.

Electrical Phenomena of the Peripheral Nerves

THE action and control of nerves must be considered in direct relation to the electrical charges on the nerve. The nerve fiber is surrounded by a membrane permeable to electrical charge and reacts thereto similarly to a condenser. The membrane is high in electrical conductivity. Negative charges cluster upon the inner surface of the membrane and follow nerve impulses; an indication that the membrane is possibly an ionic sieve, which, because of surface charge, is permeable only to cations.

Chemically phenomena, formerly considered responsible for neural impulses, are held to be only a part of the cause of neural transmissions. Electrical phases on the nerve are manifestations of activity of factors inherent in the mechanism of the nerve fibers.—*Contact Point,* 20:35-41, August 1942.

GEORGE DOUGHERTY.

Diabetes in Dentistry

STANTON L. SOBEL

REPORTS on patients with diabetes mellitis showed that general anesthesia is contraindicated because it causes vomiting. The percentage of postoperative sequelae was not higher than normal. On the anesthetics used —2 per cent procaine with no epinephrine or with 1.25 per cent epinephrine and monocaine with 1.25 per cent epinephrine—there was no significant difference. Brize, Rudy and Cohen agree that strict oral hygiene is necessary.—*Contact Point,* 20:43-48, August 1942.

W. R. ROTHGEB.

Most Recent Adaptations of Hydrocolloids in Dentistry

ALLAN D. BURKE and OLIVER FERRAN

AGAR-AGAR seems to be the essential element in hydrocolloids used in dentistry. The physical constants, such as boiling point and setting point, must be carefully regulated for such materials. The greatest advantage of hydrocolloids is their ability to be withdrawn from undercuts. They have been found satisfactory for indirect inlay, crown and partial denture work. For inlay work, the technic involves chilling the material in the mouth before removing. Models must be poured immediately after the impressions are taken. —*Contact Point,* 21:41-43, July 1943.

N. G. MCGRATH.

Effect of Various Procedures on the Theoretical Amount of Calculus Formation

ALLYN D. BURKE

A SURVEY of much literature on the factors in calculus formation indicates the importance of both internal and external factors. Any systemic disturbance causing precipitation of the lime salts of the blood may bring about formation of serumal calculus of the apices of teeth. Localized factors are the presence of phosphatase and actinomyces in saliva and the calcium and phosphorus con-

centration of the saliva.—*Contact Point,* 20: 131-136, November 1942.

KENT SMITH.

Composition, Welding and Soldering Properties of Stainless Steel as Applied to Orthodontics

GEORGE E. CASTLE

To be serviceable in orthodontics, a metal must not corrode and must be strong, elastic, economical and workable. Stainless steel fulfils these requirements, although it tends to be deficient in workability. For use in orthodontics, stainless steel alloys must contain chromium, nickel, carbon and iron and small amounts of either columbium or titanium. Owing to formation of carbides, the soldering of stainless steel is impracticable. Welding, which is influenced by the four variables of current, size of electrodes, pressure and time involved, is the most acceptable method of uniting stainless steel.—*Contact Point,* 20: 137-139, November 1942.

HARRY C. MATTISON.

Oral Manifestations of Agranulocytosis

E. M. ALLEN.

AGRANULOCYTOSIS is divided into acute and chronic primary granulopenia and secondary granulopenia. A warning is sounded against caustic agents, such as iodine. Alkaline gargles are recommended.—*Contact Point,* 20: 8, February 1943.

F. B. RUDINE.

Electrodeposition in Dentistry

NEWELL G. WOOD

THE traditional approach to the problem, the prevention of dental caries by dietary control, should be abandoned; and electrical deposition of "anti-carious" metals should form the basis of clinical practice in dental hygiene.—*Contact Point,* 20:149-150, November 1942.

EDWARD ERIGERO.

Dentistry in the Navy and the South Pacific

RICHARD F. REDDEN

"THE Dental Corps is a part of the Medical Department and the rule of the Medical Department is to keep as many men at as many guns, as many days as possible."

After indoctrination, the dental officer may be assigned to one of six possible types of duty. Routine duties ashore differ from the duties of combat. While on combat duty, the officer plays a dual rôle of dental and medical officer. "In battle, two conditions are paramount": treatment of the injured and the greatest possible dispersion of officers and men at battle dressing stations, and with repair parties.

Each ship has a different number of medical officers so that the dental officer's duties may vary. He must be well versed in the art of emergency first aid.

"In the South Pacific, air transport for the wounded has been extensively used. Mobile units on field hospitals move in with the landing forces. Casualties are then evacuated by plane, hospital ship or transport to a mobile hospital, and thence to mainland." —*Contact Point,* 21:3-6, June 1943.

R. W. MCQUILLAN.

Compilation of Signs and Symptoms Relative to Enamel Agenesia

ALFRED J. SPECKENS

TEETH showing enamel agenesia have been called "crownless teeth" or "teeth devoid of enamel." The observation of many cases shows that the enamel is abnormally thin and there is a greater distribution of dentin than is normal. The teeth seem to show a minimum of sensitivity and caries and have a short, round, blunt root. There is a strong indication of a thyroid, parathyroid or thymus infection.—*Contact Point,* 20:62-64, August 1942.

ALDO J. NICOLAI.

Gold Foil and Pulpitis

B. BASKIN

THE tooth is subjected to a variety of stresses and irritations; thermal, traumatic and electrical. Heat from burs will often cause pulpitis. The operator usually resorts to anesthesia and forgets the heat of his burs since he had eliminated the pain. Pulpitis will sometimes result from trauma, but the placing of gold foil will not cause pulpitis since foil is soft and acts as a cushion or shock absorber. The peridental membrane and the pulp are considered as one, thus an injury to one will directly involve the other. The electro-activity of metallic fillings was

at one time believed to have a harmful effect on the life of the pulp, but this belief was abandoned after recent experimentation.—*Contact Point*, 20:196-199, January 1943.

FREDERICK L. HOFFER.

Modern Tendencies in Removable Denture Prosthesis

C. BROWN and R. MILES

THE dentist is using the services of the dental technician indiscriminately. The problems met in designing partial dentures have ceased to be strictly mechanical and are subordinated to the biologic. There are two other fields of knowledge essential for the construction of partial dentures, mechanics and physics. One of the essential items in the success of a partial denture is the correct design of the retainers. The two major reasons for partial denture failure are inadequate occlusal support and inadequate saddle coverage. The prime considerations in a partial denture are protection, comfort, esthetic values, durability and utility.—*Contact Point*, 20:3-6, July 1942.

JACK WERNER.

Hypoplasia of Teeth Due to Congenital Syphilis

J. R. AITCHISON

IN 1856, Hutchinson associated congenital syphilis with hypoplasia of the teeth. However, many cases have been cited in which so-called Hutchinson's teeth appeared in families in which there was no trace of syphilis. This fact and others brought G. V. Black to the conclusion that no special disease can be blamed for the affliction. Therefore, the condition should not be considered pathognomonic of syphilis unless other evidences of that disease are present.—*Contact Point*, 20:127, October 1942.

LEONARD CARRICK.

Useful Dental Inventions of the Last Decade

MARIAN K. DONG and THEODORE MAKOWER

WITHIN the last ten years, there have not been many useful inventions. Advancement in technic and armamentarium consisted mostly in improvement and application of other technical knowledge to the dental field rather than pure invention. Thermal expansion of an inlay investment is important. The automatic scale compensates for expansion by weighing accurately and giving the necessary temperature. The mechanically controlled triturating device operates on motor pestle principles. It features an automatic timing-device trituration when amalgamation is completed.

Sweeney has devised five condenser points for the amalgam condenser which fit into a slot in the handle, rotating freely so as to adjust themselves to the contour of the cavity wall. Hollenbeck designed a pneumatic condenser which is an invaluable aid in gold foil work. True has devised a new separator that has the effectiveness of the double-bow jackscrew type, but eliminates the second bow.

A great advance has been made in the discovery of sulfanilamide and sulfathiazole. The present conception is that it inhibits the multiplication of susceptible organisms.

In orthodontia, advancement in seamless incisor, rustless steel and continuous lingual arches has been very helpful. A porcelain root-tip adapter was devised by Selberg to eliminate guesswork in baking root tips and to provide a precise technic for this difficult bridge construction. These are only a scattered few of many useful and helpful inventions in the field of dentistry.—*Contact Point*, 20:99-108, October 1942.

ELDON SCOTT.

Restoring Lost Tone to Gingival Tissue

FRANKLYN C. NELSON and JACK W. PECCHININO

THE purpose of this article is to present the more recent procedures in the treatment of periodontal conditions relative to the restoration of tissue tone. Lost tone of gingival tissue is the result of many conditions, local and systemic. The treatment for restoration of tissue tone is local mechanical and systemic, chemotherapy, surgery, electrocautery and coagulation, mechanical stimulation, home care and irradiation.

The treatments considered are those concerning the oxygen-liberating compounds, vitamin C therapy, and the most recent use of irradiation. The oxygen liberating compounds mentioned are 30 per cent superoxole and zinc peroxide. Superoxole liberates oxygen as nascent atomic oxygen rather than as a molecular oxygen. Zinc peroxide has the

ability to act upon the anaerobic streptococcus, changing it into a harmless aerobic green streptococcus. The rays used in the radiation treatment are Grenz rays. In length, the Grenz rays are halfway between x-rays and ultraviolet rays. The use of these rays is quite new and as yet has not received recognition.—*Contact Point,* 21:83, August 1943.

CHARLES GAMBOA.

Antidotes for Procaine Toxicity

RICHARD LUM

PROCAINE may have dangerous manifestations of toxicity due to (1) the susceptibility of the patient, (2) the total weight of the drug injected, (3) the strength of the solution, (4) the rate of injection, (5) the vascularity of the region injected, and (6) the position of the patient. A prophylactic medication should be used before the procaine injection. Barbituric acid derivatives administered one-half hour before injection are in use today. The medicament causes depression of the midbrain, stimulated by the anesthesia. There is clinical evidence of less severe after-effects when prophylactics are used. If stimulation occurs, an antidote may be injected intravenously. Action on the central nervous system is counteracted by the use of smelling salts and caffeine and by lowering the patient's head. In respiratory depression, artificial respiration is effective. Circulation stimulation from epinephrine resulting in an increase in blood pressure, may be checked by an injection of amyl nitrite. To bring about recovery from the depression of the circulating system, a weak solution of epinephrine is used.—*Contact Point,* 20:89-93, September 1943.

CHARLES GAMBOA.

Utilization of Calcium by Rats on High Protein-Low Calcium and High Carbohydrate-Low Calcium Diets; Effect of Supplementary Vitamin D

LAURENCE G. WESSON and PAUL E. BOYLE

EXPERIMENTS were performed to test the hypothesis that a high carbohydrate intake results in poor calcium retention and thereby an increased susceptibility to dental caries, especially in young animals whose diets are suboptimal in calcium and vitamin D. Four groups of rats, six in each, were placed on four different calcium-deficient diets. Two groups were fed calcium-low, high protein diets, one with and one without supplemental vitamin D. The other two groups were fed low-calcium, high-carbohydrate diets, one with and one without supplemental vitamin D. Ingestion of vitamin D markedly increased growth, survival time, retention of calcium and calcium content of the bones in animals on the high carbohydrate diet, but it had no effect on those on the high protein diet. However, calcification of teeth and bony and tooth structure were improved in rats on both diets by supplementing with vitamin D. Apparently, the protein level, if too high, can be a limiting factor in calcium retention and the effectiveness of vitamin D.—*Arch. Path.,* 36:237, September 1943.

DAVID B. SCOTT.

Influence of Vitamin D on the Structure of the Teeth and of the Bones of Rats on Low Calcium Diets

P. E. BOYLE and L. G. WESSON

IN the continuation of a previous study, observations were similar to those described earlier. Vitamin D supplements promoted growth, improved appetite and increased retention of calcium and the degree of calcification of bones in rats on low calcium-high carbohydrate diets, but they had no effect in these respects on animals on high protein-low calcium diet. Vitamin D, however, improved the structure of bones and teeth in animals on both diets. Teeth in animals low in vitamin D were abnormal, showing wide uncalcified predentin and globular calcification of the dentin, while those in animals receiving supplements of vitamin D appeared normal. Bone shafts and trabeculae in animals on a diet supplemented with vitamin D showed atrophy, but were otherwise almost normal. Rats on vitamin D deficient diets showed active resorption and re-formation, resulting in the production of fibrous marrow spaces, resembling those in the osteitis fibrosa of hyperparathyroidism. It is suggested that ingestion of vitamin D may promote normal calcification of teeth and bones, even under adverse circumstances, a situation which the authors compare to the action of the "liver factor" in promoting normal maturation of erythrocytes in per-

nicious anemia.—*Arch Path.*, 36:243, September 1943.

DAVID B. SCOTT.

Acute Membranous Stomatitis and Conjunctivitis

J. A. LANGILLE

THE three cases described had several features in common. Each showed severe infection of the eyes and mouth. All showed malnutrition, with low vitamin intake, especially B complex and C. Gram-positive diplococci, considered to be streptococci, were isolated from the lesions. The infections resisted local treatment and sulfonamide therapy, but cleared up readily on high vitamin diet.—*Canad. M. A. J.*, 50:141, February 1944.

DAVID B. SCOTT.

Effect of Quinones on Acid Formation in Saliva

W. D. ARMSTRONG and J. W. KNUTSON

THIRTEEN quinone compounds were tested for antibacterial activity by incubation with a saliva-glucose mixture. 1-4 naphthoquinone had the greatest antibacterial effect, being considerably superior to 2 methyl—1, 4—naphthoquinone. Both these compounds have synthetic vitamin K potencies, and the latter is supposed to exhibit ten times the vitamin K potency of the former. This leads the authors to believe that the antibacterial activity is a secondary characteristic of the quinones, and not a property of vitamin K activity itself. This is farther substantiated by the fact that 1-2 naphthoquinone and benzoquinone, both of which have negligible vitamin K potencies, are quite substantially antibacterial. Some sort of relationship between red-ox potentials of quinones and their antibacterial properties may exist, but such evidence is not yet available.—*Proc. Exper. Biol. & Med.*, 52:307, April 1943.

DAVID B. SCOTT.

Postwar Implications of Fluorine and Dental Health. Epidemiologic Aspects

H. TRENDLEY DEAN

THIS paper briefly reviews some of the epidemiologic evidence of the possibility of partially controlling the dental caries incidence by low fluorination of the common water supply. The per capita cost would be low, and the concentration (1 part per million) would not involve adding anything not already found in water supplies used by more than a million people in this country. However, before any attempt is made to institute such procedures generally, properly planned and controlled studies must demonstrate the safety and harmlessness of low fluorination as it relates to general health. Should such studies prove successful, domestic water supplies might be classified in three groups: 1. Those with optimum fluoride concentration (1 part per million). 2. Those with excessive fluoride concentration and requiring its removal. 3. Those deficient in fluoride and requiring added fluoride to bring its concentration to the optimum to check a dental caries attack. —*Am. J. Pub. Health*, 34:133, February 1944.

PAUL H. KEYES.

Postwar Implications of Fluorine and Dental Health Problem to Waterworks Engineer

RAYMOND J. FAUST

THE problems of control of the fluoride content of water supplies are discussed from the point of view of reducing excess fluoride and adding optimal quantities. Since reducing the fluoride content may be difficult and expensive, a complete change of water supply may be the best solution in such cases. Adding fluoride to water supplies should not be difficult, since accurate, durable and inexpensive chemical feed equipment is available. The cost would be approximately $7\frac{1}{2}$ cents per person per year. A quick, accurate test for fluoride, by use of permanent color standards, is needed before general treatment can be begun. Legally, the responsibility of a water supply utility adding fluoride remains unchanged. Supervision by state health authorities is desirable.—*Am. J. Pub. Health*, 34:144, February 1944.

PAUL H. KEYES.

Fluorosis and Dental Caries on Tyneside

ROBERT WEAVER

EPIDEMIOLOGIC studies made in North Shields and South Shields, on opposite sides of the Tyne River, showed the two British

towns to be similar in climate and social and economic conditions, but different in water supply. North Shields has less than 0.25 part per million of fluorine, while South Shields has 1.4. In each town, the teeth of 500 children aged 5 years and 500 aged 12 years were examined. For permanent teeth, the dental caries incidence in South Shields was 56 per cent below that in North Shields. Slightly greater evidence of mottling was observed in South Shields. According to evidence presented, there is no significant delay in eruption of permanent teeth in South Shields; no relationship between mottling and caries incidence, no relation between mottling and nutrition, and no relation between nutrition and caries experience.—*Brit. D. J.*, 76:2, January 21, 1944.

PAUL H. KEYES.

Cow's Milk and Honey as an Exclusive Diet

MYKOLA H. HAYDAK ET AL.

FIVE healthy subjects (22-24 years) were put on a diet of milk and honey, mixed in the proportion of 100 gm. of honey to 1 quart of milk, plus daily supplements of 65 mg. of ascorbic acid and 1 mg. of thiamine. In two control and test periods of about one month, blood and urine analyses were, for the most part, within the limits of normal variation of hemoglobin, calcium, inorganic phosphorus, magnesium and riboflavin. Blood levels of ascorbic, pantothenic and nicotinic acid were low, but urinary excretions were approximately normal. Thiamine excretion was subnormal despite supplements. Careful dental studies showed no roentgenographic changes. One subject showed no clinical changes, but the others developed a heavy white cheesy film, covering teeth and gums, redness of the marginal gingivae, and general oral hyperemia. One subject developed tongue lesions. Although brushing did not remove the film once it was formed, it disappeared after the subjects resumed a normal diet, as did the tongue lesions. Two reported soreness and numbness of the teeth upon first masticating solid food. The diet was adequate to maintain life, but not to entirely prevent deficiency symptoms.—*Am. J. M. Sc.*, 207:209, February 1944.

PAUL H. KEYES.

Sculpturally Molded Synthetic Implants in Plastic Surgery

ADOLPH M. BROWN

THE author reports the use of acrylic resin implants in plastic surgery for the correction of facial defects. The technic for molding methyl methacrylate implants is described and photographs of actual cases are shown. Some advantages of acrylic implants are: good tissue tolerance, ability to be molded to any desired contour, permanency of size and shape and elimination of curling and slipping.—*Arch. Otolaryn.*, 39:179, February 1944.

PAUL H. KEYES.

Histoplasmosis and Its Importance to Otorhinolaryngologists

M. MOORE and L. H. JORSTAD

HISTOPLASMOSIS, or reticulo-endothelial cytomycosis, is a fungus infection characterized usually by fever, weight loss or emaciation, anemia, leukopenia and splenohepatomegaly with a marked invasion by reticuloendothelial histiocytes containing organisms. The disease may be acute or chronic, cutaneous or systemic, localized or generalized and may involve several of many organs. Histoplasmosis can simulate carcinoma, otitis media, rhinoscleroma, noma, lymphoma and other conditions. A case is presented with an involvement of the buccal mucosa and hard palate which simulated carcinoma. The patient complained of a painless "sore" in the roof of the mouth of two months' duration. Diagnosis was made from a biopsy specimen taken from the right upper alveolus and the lower gum. The patient grew progressively worse in spite of treatment and died about five months after first being seen. A review of the literature is presented.—*Ann. Otol., Rhin. & Laryng*, 52:799, December 1943.

S. J. FANALE.

Dental Findings in Four Cases of Cleidocranial Dysostosis

J. A. MILLHON and L. T. AUSTIN

CLEIDOCRANIAL dysostosis presents unusual dental abnormalities. The findings are relatively constant. The deciduous teeth erupt normally and are retained longer, while the permanent teeth may lose their eruption stimulus, remaining embedded in the jaws. It is probably best to refrain from whole-

sale removal of these embedded teeth since they are generally deeply situated and too much alveolar process must be removed. There is a tendency to formation of supernumerary permanent teeth, and geminated teeth are commonly seen. The maxillae are relatively underdeveloped and have a micrognathous appearance. The palate tends to be narrow and high, and there may be a failure of the two maxillary parts to fuse. Four case reports are presented.—*Am. J. Orthodontics,* 30:30, January 1944.

S. J. FANALE.

Sublingual Granuloma in Infancy (Riga-Fede's Disease)

M. ABRAMSON and J. O. DOURIE

REPORTED most frequently in southern Italy, Riga-Fede's disease usually appears in young infants shortly after the eruption of the lower central incisors. Moncrieff believes it to be an inflammatory granuloma of the frenum linguae arising as a result of mechanical trauma and secondary nonspecific infection. Repeated irritation of the lingual frenum on incisal edges of the lower central incisors initiates the condition. Granulation tissue forms, producing a tumor-like mass, usually discoid and about 1 cm. in diameter. Sometimes, this may make nursing difficult. An ulcerated area covered with a pseudomembrane is usually seen, without associated lymphadenopathy or adjacent inflammation. Two cases are reported. Excision resulted in prompt recovery. —*J. Pediat.,* 24:195, January 1944.

S. J. FANALE.

Multiple Myeloma First Discovered in the Mandible

E. WOLFF and L. E. NOLAN

THE authors report a case of multiple myeloma first discovered in the mandible, and apparently arising there. A review of the literature failed to disclose any similar cases. Myeloma is a rare tumor arising from blood-forming cells of the bone marrow. On discovery, it is usually present in more than one bone. In this case, the patient complained of pain and facial swelling of eight weeks' duration. X-ray examination revealed a large, sharply defined, circumscribed area of decreased density, involving most of the body of the left mandible, and extending from the symphysis to the angle, with only a thin shell of bone remaining at the margin of the tumor. There was no evidence of similar lesions in other bones, although the skull showed minute punched-out areas in both parietal bones. A biopsy of the mandibular lesion disclosed it to be a myeloma of the plasma cell type. The lesion was controlled by deep x-ray therapy, with a subsidence of swelling and complete relief of pain and tenderness.—*Radiology,* 42:76, January 1944.

S. J. FANALE.

Rheumatic Fever in Its Relation to Dental Disease

L. M. TARAN

THE incidence of decay in a group of rheumatic children is greater than in a normal group. About 2 per cent of the child population in the temperate zone of our country have rheumatic disease. The majority of these cases need dental care. The observation is made that removal of decayed teeth improves the general health of rheumatic children. Of 295 patients who had one or more extractions, only three had recurrences immediately after the extraction; seven developed recurrences from three to six weeks later, while four had a mild reactivation. Prophylactic sulfonamide therapy before and after extraction tends to prevent the serious complication of subacute bacterial endocarditis. Children with severe cardiac damage do not present poor risks for dental extraction unless there is decompensation at the time of extraction.—*New York J. Dent.,* 14:107, March 1944.

S. J. FANALE.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

AMERICAN ASSOCIATION OF ORTHODONTISTS, Chicago, Ill., April 25-27.

AMERICAN BOARD OF ORTHODONTICS, Chicago, April 23-24.

AMERICAN DENTAL ASSISTANTS ASSOCIATION, Omaha, Nebr., October 9-12.

AMERICAN DENTAL ASSOCIATION, Omaha, Nebr., October 9-11.

AMERICAN DIETETIC ASSOCIATION, Chicago, Ill., October 25-27.

CLEVELAND DENTAL SOCIETY, May 8-10.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second Tuesday in each month, at the Medical Society Auditorium, Washington.

GREAT LAKES SOCIETY OF ORTHODONTISTS, Toledo, Ohio, October 23-24.

KANSAS STATE DENTAL ASSISTANTS' ASSOCIATION, Topeka, May 3-4.

UNIVERSITY OF MARYLAND DENTAL SCHOOL CLASS OF 1904, Baltimore, May 1-3.

NATIONAL BOARD OF DENTAL EXAMINERS, May 1-2 and July 31-August 1.

NATIONAL DENTAL ASSOCIATION, Cleveland, Ohio, August 14-18.

ONTARIO DENTAL ASSOCIATION, Toronto, Canada, May 29-31.

WOMEN'S DENTAL SOCIETY OF NEW YORK, New York, N. Y., March 15, May 17, September 20 and November 15.

STATE SOCIETIES

April

Alabama, at Birmingham (10-13)
Kentucky, at Louisville (3-5)
Louisiana, at Shreveport (13-15)
Michigan, at Detroit (17-19)
Mississippi, at Jackson (23-25)
Oklahoma, at Tulsa (16-19)
South Carolina, at Columbia (24-25)
Virginia, at Richmond (3-5)

May

Connecticut, at New Haven (26-27)
Georgia, at Atlanta (7-10)
Illinois, at Springfield (8-11)
Kansas, at Topeka (3-4)
Maryland, at Baltimore (1-2)
Missouri, at Jefferson City (1-3)
Montana, at Billings 4-6)
New Jersey, at Atlantic City (3-5)
New York, at Buffalo (9-12)
North Carolina, at Raleigh (1-3)
Tennessee, at Memphis (22-25)

September

Southern California, at Los Angeles (19-21)

STATE BOARDS OF DENTAL EXAMINERS

Colorado, at Denver, June 19-24. Ezra E. Schaefer, 606 Republic Bldg., Denver, Colo.

Connecticut, at Hartford, June 20-24. Clarence G. Brooks, 320 State St., New London, Recorder.

Indiana, at Indianapolis, April 24-27. Carl A. Frech, Gary National Bank Bldg., Gary, Secretary.

Iowa, at Iowa City, April 17-21. Harry G. Bolks, Badgerow Bldg., Sioux City, Secretary.

North Carolina, at Raleigh, September 25. Wilbert Jackson, Rich Bldg., Clinton, Secretary.

North Dakota, at Fargo, July 10-13. R. A. Andrews, Carrington, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, May 19-20 (dental hygiene) and June 6-10. Reuben E. V. Miller, 61 N. Third St., Easton, Secretary.

Vermont, at Montpelier, June 26-28. Charles I. Taggart, 139 Bank St., Burlington, Secretary.

West Virginia, at West Liberty, June 26-28 (dental and dental hygiene). R. H. Davis, Goff Bldg., Clarksburg, Secretary.

AMERICAN ASSOCIATION OF ORTHODONTISTS

THE next meeting of the American Association of Orthodontists will be held at

the Edgewater Beach Hotel, Chicago, Ill., April 25-27. Members of the American Dental Association are invited to attend this meeting upon the presentation of proper credentials and payment of the registration fee. Credentials should be obtained in advance from the secretary of the American Association of Orthodontists or the secretary of a constituent orthodontic society.

MAX E. ERNST, *Secretary,*
1250 Lowry Medical Arts Building,
St. Paul 2, Minn.

AMERICAN ASSOCIATION OF ORTHODONTISTS RESEARCH SECTION

AT the present time, there is no opportunity afforded men interested in orthodontic research to meet to discuss their problems. At the last meeting of the American Association of Orthodontists, it was proposed that the Research Committee be empowered to arrange a portion of the program for the next annual meeting, to be held in Chicago, April 25-27.

The program will consume one-half day and will be restricted to ten or fifteen minute reports by men actively engaged in research in orthodontia or its allied fields. Time will be allowed for discussion of all presentations, in order that the greatest benefit may accrue to those participating. All institutions and all individuals are invited to request time.

For further information or time reservations on the program, address

ALLAN G. BRODIE, *Chairman,*
Research Committee, A. A. O.,
30 North Michigan Ave.,
Chicago, Ill.

AMERICAN BOARD OF ORTHODONTICS

THE 1944 meeting of the American Board of Orthodontics will be held at the Edgewater Beach Hotel, Chicago, Ill., April 23 and 24. Orthodontists who may desire to be certificated by the Board can obtain application blanks from the secretary, Bernard G. deVries, 705 Medical Arts Bldg., Minneapolis, Minn.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

THE Twentieth Annual Session of the American Dental Assistants Association will be held in Omaha, Nebr., October 9-12. For further information, address

AILEEN M. FERGUSON,
General Secretary,
709 Centre St.,
Jamaica Plain, Mass.

AMERICAN DENTAL ASSOCIATION

THE next annual meeting of the House of Delegates of the American Dental Association will be held in Omaha, Nebr., October 9-11.

HARRY B. PINNEY, *Secretary,*
222 East Superior St.,
Chicago 11, Ill.

AMERICAN DIETETIC ASSOCIATION

THE annual meeting of the American Dietetic Association will be held at the Palmer House, Chicago, Ill., October 25-27. The sessions will be devoted to discussion of plans and problems relating to food and nutrition in connection with the war. Topics will include progress of the acceleration program to increase the number of qualified dietitians; improvement in methods in teaching student nurses; recruitment of dietitians for the Army; administrative food problems; newer developments in diet therapy; maternal and child nutrition; school lunch problems; rationing and food supplies; labor policies in food service units, and food technology. There will also be discussions of postwar plans and the extent to which the Association and its members can participate. Details of the program will be released as they develop.

CLEVELAND DENTAL SOCIETY ANNUAL SPRING CLINIC MEETING

THE Annual Spring Clinic Meeting of the Cleveland Dental Society will be held at the Hotel Carter, May 8-10.

H. C. ALEXANDER,
Windermere Theatre Bldg.,
East Cleveland, Ohio.

DISTRICT OF COLUMBIA DENTAL SOCIETY

THE District of Columbia Dental Society holds its meetings on the second Tuesday of every month, at the Medical Society Auditorium, 1718 M. St., N.W., Washington.

J. WALTER BERNHARD, *Secretary,*
1835 Eye St., N.W.,
Washington.

GREAT LAKES SOCIETY OF ORTHODONTISTS

THE next meeting of the Great Lakes Society of Orthodontists will be held October 23-24 at the Commodore Perry Hotel, Toledo, Ohio.

C. EDWARD MARTINEK, *Secretary,*
661 Fisher Bldg.,
Rochester, N. Y.

KANSAS STATE DENTAL ASSISTANTS' ASSOCIATION

THE annual meeting of the Kansas State Dental Assistants' Association will be held at the Jayhawk Hotel, Topeka, May 3-4.

ROBERTA GAWTHROP, *Secretary.*

UNIVERSITY OF MARYLAND DENTAL SCHOOL CLASS OF 1904

A REUNION of the Class of 1904, Dental School, University of Maryland to celebrate its fortieth anniversary will be held during the annual meeting of the Maryland State Dental Association, May 1-3, in Baltimore at the Belvedere Hotel. For further information, address

WALTER E. GREEN, *Secretary,*
2958 W. North Ave.,
Baltimore.

NATIONAL BOARD OF DENTAL EXAMINERS

THE National Board of Dental Examiners will hold its next two sessions for the examination of candidates in Part 1 and 2, May 1-2 and July 31-August 1 in schools where there are five or more candidates. For further information, address

GORDON L. TEALL, *Secretary,*
Box 71,
Hiawatha, Kan.

NATIONAL DENTAL ASSOCIATION

THE National Dental Association will hold its thirtieth annual session August 14-18 at the New Central High School, Cleveland, Ohio. For further information, address

J. A. JACKSON, *Secretary,*
Charlottesville, Va.

ONTARIO DENTAL ASSOCIATION

THE Seventy-Seventh Annual Convention of the Ontario Dental Association will be held at the Royal York Hotel, Toronto, May 29-31. Dentists from the United States and all parts of Canada will be welcome.

EDMUND A. GRANT, *Secretary,*
86 Bloor St. West,
Toronto, Canada.

WOMEN'S DENTAL SOCIETY OF NEW YORK

THE Women's Dental Society of New York will hold four meetings during the year, March 15, May 17, September 20 and November 15. All meetings will be held at the Pennsylvania Hotel, New York, beginning at 8 p.m. The speaker for the first meeting will be John Jacob Posner, New York, whose subject will be "Simplified Local Anesthesia," illustrated with motion pictures. Ethical practitioners of dentistry are invited. The society officers for the coming year are Hannah Appel, president; Sadie Goodman, vice-president; Charlotte Brickner, secretary; Rose Cohen, treasurer.

MATHILDE FREUND, *Chairman,*
Publicity Committee,
Scarsdale, N. Y.

ALABAMA DENTAL ASSOCIATION

THE annual meeting of the Alabama Dental Association will be held at the Tutwiler Hotel in Birmingham, April 10-13.

PRYOR A. WILLIAMS, *Secretary,*
1005 Protective Life Bldg.,
Birmingham.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

THE annual meeting of the Southern California State Dental Association will be held at the Biltmore Hotel, Los Angeles, September 19-21.

ROBERT L. BORLAND, *Secretary,*
756 S. Broadway,
Los Angeles 14.

CONNECTICUT STATE DENTAL ASSOCIATION

THE Eightieth Annual Meeting of the Connecticut State Dental Association will be held at the Hotel Taft, New Haven, May 26-27.

EARLE S. ARNOLD, *Secretary,*
37 Linnard Road,
West Hartford 7.

GEORGIA DENTAL ASSOCIATION

THE seventy-sixth annual meeting of the Georgia Dental Association will be held in Atlanta, May 7-10, with headquarters at the Ansley Hotel.

R. H. MURPHY, *Secretary,*
605 Bankers Insurance Bldg.,
Macon.

ILLINOIS STATE DENTAL SOCIETY

THE next meeting of the Illinois State Dental Society will be held in Springfield, May 8-11.

L. H. JACOB, *Secretary,*
Jefferson Bldg.,
Peoria 2.

KANSAS STATE DENTAL ASSOCIATION

THE Seventy-Third Annual Session of the Kansas State Dental Association will be held at the Hotel Kansan, Topeka, May 3-4.

FRED A. RICHMOND, *Secretary,*
Huron Bldg.,
Kansas City.

KENTUCKY STATE DENTAL ASSOCIATION

THE eighty-fourth annual meeting of the Kentucky State Dental Association will be held at the Brown Hotel, Louisville, April 3-5.

J. L. WALKER, *Secretary,*
640 Barbee Way South,
Louisville.

LOUISIANA STATE DENTAL SOCIETY

THE next meeting of the Louisiana State Dental Society will be held April 13-15, at the Washington-Youree Hotel, Shreveport.

MARYLAND STATE DENTAL ASSOCIATION

THE Sixty-First Annual Meeting of the Maryland State Dental Association will be held in Baltimore, May 1-2, at the Belvedere Hotel.

PAUL A. DEEMS, *Secretary,*
835 Park Ave.,
Baltimore.

MICHIGAN STATE DENTAL SOCIETY

THE Eighty-Eighth Annual Meeting of the Michigan State Dental Society will be held at the Hotel Statler, Detroit, April 17-19.

S. G. APPLEGATE,
General Chairman,
630 E. Jefferson Ave.,
Detroit.

MISSISSIPPI DENTAL ASSOCIATION

THE Mississippi Dental Association will hold its sixty-ninth annual meeting at the Robert E. Lee Hotel, Jackson, April 23-25.

O. L. COLEE, *Secretary.*

MISSOURI STATE DENTAL ASSOCIATION

THE next meeting of the Missouri State Dental Association will be held at Jefferson City, May 1-3, at the Governor Hotel.

C. W. DIGGES, *Secretary,*
Exchange National Bank Bldg.,
Columbia.

MONTANA STATE DENTAL ASSOCIATION

THE 1944 meeting of the Montana State Dental Association will be held in Billings, May 4-6.

T. T. RIDER, *Secretary,*
9 Higgins Block,
Missoula.

NEW JERSEY STATE DENTAL SOCIETY

THE New Jersey State Dental Society will hold its seventy-fourth annual meeting May 3-5 at the Claridge Hotel, Atlantic City.

F. K. HEAZELTON, *Secretary,*
223 E. Hanover St.,
Trenton 8.

DENTAL SOCIETY OF THE STATE OF NEW YORK

THE seventy-sixth annual meeting of the Dental Society of the State of New York will be held in the Hotel Statler, Buffalo, May 9-12. In conjunction with the meeting, there will be suitable exercises commemorating the centennial of the discovery of the use of nitrous oxide in surgical procedures. Arthur H. Merritt, Past President of the American Dental Association and a member of the Horace G. Wells Centenary Committee, will give an address on "Horace G. Wells—Discoverer of Surgical Anesthesia." The scientific program will include eight essays, ten registered clinics, six postgraduate courses,

six topic discussions and thirty table clinics. Lieut. Cmdr. F. E. Frates (DC), USN, will talk on "The South Pacific as Reflected in a Mouth Mirror." Capt. C. Raymond Wells (DC), USNR, and President of the American Dental Association, will participate May 12 in the outdoor public presentation to the armed services of a medium size tank and a mobile dental laboratory unit. The latter is of the newest type of movable war equipment sanctioned for use in the combat areas overseas. Until the development of this ten-wheeler, service men in need of dentures or of denture repair had to be evacuated to some fixed installation in the rear where laboratory facilities were available. The new mobile laboratory can get to the area where the fighting is heaviest and thus will greatly contribute to the war effort. Both of these contributions were made possible by the energetic campaign of the Scrap and Salvage Committee, Carl Sachse, chairman. In keeping with the desire of the society to avoid taxing the manpower and facilities of the hotel, the party, May 11, honoring the president, Leon Abbey, of Schenectady, will be simple. Because of the added demands upon railroad transportation, early roundtrip reservations are advised.

CHARLES A. WILKIE, *Secretary,*
1 Hanson Place,
Brooklyn 17.

NORTH CAROLINA DENTAL SOCIETY

THE Seventieth Annual Meeting of the North Carolina Dental Society will be held at the Hotel Sir Walter Raleigh, May 1-3.

E. M. MEDLIN, *Secretary,*
Aberdeen.

OKLAHOMA STATE DENTAL SOCIETY

THE next meeting of the Oklahoma State Dental Society will be held April 16-19 at the Mayo Hotel, Tulsa.

EUGENE W. WISE.
Medical Arts Bldg.,
Tulsa.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

THE next meeting of the South Carolina State Dental Association will be held at the Columbia Hotel, Columbia, April 24-25.

L. E. DELLINGER, *President,*
Greenville.

TENNESSEE STATE DENTAL ASSOCIATION

THE next annual meeting of the Tennessee State Dental Association will be held at the Hotel Peabody, Memphis, May 22-25.

E. JEFF JUSTIS, *Secretary,*
1504 Exchange Bldg.,
Memphis.

VIRGINIA STATE DENTAL ASSOCIATION

THE Virginia State Dental Association will hold its next annual meeting April 3-5, at the John Marshall Hotel, Richmond.

J. E. JOHN, *Secretary,*
Medical Arts Bldg.,
Roanoke.

COLORADO STATE BOARD OF DENTAL EXAMINERS

THE Colorado State Board of Dental Examiners will hold its next examination in Denver June 19-24. All credentials and fees must be filed with the secretary at least two weeks before the examination.

EZRA E. SCHAEFER, *Secretary,*
606 Republic Bldg.,
Denver.

CONNECTICUT DENTAL COMMISSION

THE Connecticut Dental Commission will meet in Hartford, June 20-24, for the examination of applicants for license to practice dentistry and dental hygiene and to transact any other business proper to come before it. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

CLARENCE G. BROOKS, *Recorder,*
302 State St.,
New London.

INDIANA STATE BOARD OF DENTAL EXAMINERS

THE Indiana State Board of Dental Examiners will hold its next examination in Indianapolis, April 24-27. All credentials and fees must be filed with the secretary at least two weeks prior to the examination.

CARL A. FRECH, *Secretary,*
Gary Nat'l Bank Bldg.,
Gary.

IOWA STATE BOARD OF DENTAL EXAMINERS

THE Iowa State Board of Dental Examiners will hold its next examination at the College of Dentistry, State University of Iowa, Iowa City, April 17-21. Application with necessary fee must be in the hands of Mr. H. W. Grefe, director of Licensure and Registration, Iowa State Department of Health, Des Moines, fifteen days before the examination.

HARRY G. BOLKS, *Secretary,*
Badgerow Bldg.,
Sioux City.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the North Carolina State Board of Dental Examiners for the examination of applicants for licensure will be held at the State Capitol, Raleigh, beginning September 25. Applications must be filed with the secretary thirty days before the examination. For application blanks and further information, address

WILBERT JACKSON, *Secretary,*
Rich Bldg.,
Clinton.

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

THE North Dakota State Board of Dental Examiners will hold its next examination at the Gardner Hotel, Fargo, July 10-13. Applications should be in the hands of the secretary ten days earlier. For further information and application, address

R. A. ANDREWS, *Secretary,*
Carrington.

DENTAL COUNCIL AND EXAMINING BOARD OF THE COMMONWEALTH OF PENNSYLVANIA

THE Dental Council and Examining Board of the Commonwealth of Pennsylvania will meet in Philadelphia and Pittsburgh, May 19-20, to examine dental hygiene applicants. Applicants for licensure to practice dentistry will be examined in Philadelphia and Pittsburgh, June 6-10. For further information and application blanks, address the Department of Public Instruction, Bureau of Professional Licensing, Dental Division, Harrisburg.

REUBEN E. V. MILLER, *Secretary,*
61 N. Third St.,
Easton.

STATE OF VERMONT BOARD OF DENTAL EXAMINERS

THE Vermont State Board of Dental Examiners will meet at the State House, Montpelier, June 26-28, for the purpose of examining candidates for license to practice in the State of Vermont. Address all inquiries to

CHARLES I. TAGGART, *Secretary,*
139 Bank St.,
Burlington.

WEST VIRGINIA STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the West Virginia State Board of Dental Examiners will be held at West Liberty State College, West Liberty, June 26-28. Examinations for licensure of dentists and dental hygienists will be held. All applications must be in the office of the secretary by June 16.

R. H. DAVIS, *Secretary,*
Goff Bldg.,
Clarksburg.

PAN AMERICAN ODONTOLOGICAL ASSOCIATION SCHOLARSHIP

THE Pan American Odontological Association takes pleasure in announcing an annual scholarship at the Tufts College Dental School, Boston, Mass., for graduate dentists from any of the Latin American countries. The subjects of study include: complete denture prosthesis, partial denture prosthesis, minor oral surgery, operative dentistry, ceramics, children's dentistry, root surgery and radiology, preventive dentistry and treatment of parodontal diseases.

This annual scholarship is an addition to the already available Pan American Odontological Association scholarships at the New York University, College of Dentistry; Evans Dental Institute, School of Dentistry, University of Pennsylvania, and the W. K. Kellogg Foundation Institute, Graduate and Postgraduate Dentistry, University of Michigan.

RALPH HOWARD BRODSKY, D.M.D.,
Executive Secretary,
14 East 81st St.,
New York 28, N. Y.

VOLUNTEERSHIPS AND EXTERNSHIPS, BRONX HOSPITAL

THERE are several volunteerships and

externships available for recent graduates at the dental clinic, Bronx Hospital, in the following departments: oral surgery and exodontia, operative dentistry, orthodontia, surgical periodontia and root canal therapy. Applicants address David Wurzel, director of the Dental Department, Bronx Hospital, 169th St. & Fulton Ave., Bronx, New York.

DENTAL INTERNSHIPS

Two internships are available at the St. Louis City Hospital for recent dental graduates. Opportunity is afforded for training and experience in dental and oral surgery, diagnosis and other phases of dentistry. Applicants should address Leo J. Wade, Medical Director, or Hamilton B. G. Robinson, D.D.S., City Hospital, 1515 Lafayette Ave., St. Louis, Mo.

DENTAL INTERNSHIPS

THE Greater New York Conference of Hospital Dental Services, comprised of a group of men who are chiefs of dental services, would like to aid those men seeking dental internships in hospitals in the metropolitan area. Those who are not in the Army or the Navy and who are desirous of obtaining internships should communicate with

MARY E. REILLY, *Secretary,*
386 Fourth Ave.,
New York, N. Y.

DENTAL INTERNSHIP

AN internship is available to a recent dental graduate at the Research and Educational Hospital of the University of Illinois Medical Center. An unusual opportunity is afforded for training and experience in hospital dentistry and the medical aspects of dental disease. Application forms can be obtained from the Dean, University of Illinois College of Dentistry, 808 South Wood St., Chicago 12, Ill.

DENTAL EXTERNSHIPS

VOLUNTEER dental externships are available in the Research and Educational Hospital to dental practitioners desiring training and experience in hospital dentistry, dentistry for children and the dental aspects of systemic disease. Application forms can be obtained from the Dean, University of Illinois College of Dentistry, 808 South Wood St., Chicago 12, Ill.

UNIVERSITY OF CALIFORNIA RESEARCH ASSISTANT

THE College of Dentistry, University of California has an appointment as research assistant available for a qualified person beginning June 30. The appointment is in the Division of Dental Medicine and is for one year. This may be extended for an additional year.

This appointment is designed primarily for dental graduates with an interest in dental research and teaching. However, this dental degree requirement can be waived if other qualifications justify it.

The basic salary is $1,500 a year, plus an emergency increase to care for added living costs.

Application forms can be obtained from the Dean of the College of Dentistry, University of California, San Francisco, Calif.

WILLARD C. FLEMING, *Dean.*

UNIVERSITY OF ILLINOIS RESEARCH FELLOWSHIPS

APPLICATIONS for Research Fellowships in Medicine, Dentistry and Pharmacy in the University of Illinois are now being considered for the year beginning September 1, 1944. Appointments to these Fellowships will be announced January 1.

Candidates for these Fellowships must have completed a training of not less than eight years beyond high school graduation. The Fellowship carries a stipend of $1,200 per calendar year with one month's vacation.

Application blanks and further information can be secured from the secretary of the Committee on Graduate Work in Medicine, Dentistry and Pharmacy, 1853 West Polk St., Chicago 12, Ill.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation of the New York and the Eastman Dental Clinic, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is

given the title of Fellow in Dentistry and, according to his interests, works as a graduate student in one of the departments of the medical schools. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduates Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Applications should be made to

GEORGE H. WHIPPLE, *Dean,*
Rochester, N. Y.

OHIO STATE UNIVERSITY POSTGRADUATE COURSES IN DENTISTRY

THE College of Dentistry of the Ohio State University, at Columbus, offers postgraduate courses in dentistry that are especially designed for the general practitioner who may wish to amplify his training in any of the following fields: oral surgery, prosthodontia, radiology, crown and bridgework, operative dentistry and root-canal therapy. The length and dates of the courses are as follows:

Oral surgery	June 12 to 16
Prosthodontia	June 12 to 17
Crown and bridge	June 12 to 16
Operative dentistry	June 12 to 16
Root canal therapy	June 12 to 16
Radiology	June 19 to 23

The fees for these courses will be $50 a week, with the registration limited to ten in each course, with the exception of prosthodontia, which will be $100 for the week's course, with registration limited to five.

It is the aim of these courses to teach new technics as well as to review the fundamentals. Further information and application blanks can be secured from the office of the dean, College of Dentistry, Ohio State University, Columbus.

FEDERAL POSITIONS FOR DENTAL HYGIENISTS

THE United States Civil Service Commission is continuing to recruit dental hygienists for federal positions. Experience is no longer necessary. Completion of a full course leading to graduation from a recognized school of oral hygiene and registration as a dental or oral hygienist in a state, territory or the District of Columbia will qualify applicants. Students enrolled in schools of oral hygiene may apply for federal positions when they are within nine months of completion of the course and may enter on duty on completion and registration. There are no age limits for the positions and no written tests. Appointees receive $1,970 a year entrance salary, which incorporates compensation for the eight hours of overtime included in the present forty-eight hour federal work week. The majority of positions are in Army hospitals and dispensaries throughout the country, particularly in the West and Southwest. Vacancies may occur also in the Veterans' Administration and the Public Health Service. Applications should be filed with the Civil Service Commission, Washington, 25, D. C.

W. C. HULL, *Executive Assistant,*
United States Civil Service Commission,
Washington, D. C.